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(Volume Title, Contents and Index will appear in next issue)

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CHILD DEVELOPMENT

This number includes reports of mental abilities in relation to environmental conditions of mountain children; of muscular and emotional development in infancy; and of the development of language and word meaning.

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CHILD DEVELOPMENT

Contents for December

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The Intelligence of Isolated Mountain Children[1]

MANDEL SHERMAN AND CORA B. KEY

THIS report of the results of intelligence tests made of mountain children is part of a larger study begun in the summer of 1929 to determine the cultural influences which affect intellectual, emotional and personality development and the influences determining the attitudes of mountain people living in relative degrees of isolation.

The communities studied were 4 hollows located approximately 100 miles west of Washington, D. C., in the Blue Ridge Mountains and a small village at the base of the Blue Ridge about the same distance from Washington to the southwest. Of great significance is the ancestry of these people. The Hollows were settled in the pre-colonial period by English and Scotch-Irish immigrants. When German immigrants were given most of the land in the Shenandoah valley surrounding these mountain ranges the English and Scotch-Irish people were forced up the mountainside. The topography of this region is such that the settlers were forced further within the mountains, settling in hollows surrounded by mountain ranges. There they built their log and mud cabins many of which still remain and are inhabited. Each of the hollows selected for study, Colvin, Needles, Oakton and Rigby are close to each other but are separated by comparatively high mountain ranges. Of these Hollows, Colvin is at the lowest level in social development. This hollow is small, consisting of a small number of families living in scattered, mud-plastered log huts. There is no road, except for a trail, to the outside world. One small log and mud cabin is rented by the county school board for a school. There is no general meeting place and the church meetings which have been held in the past have been discontinued except for a very occasional revival meeting. With three exceptions, the adults are illiterate. They are descendents of the original settlers who married relatives and mixed very little with the people outside of the hollows. Colvin Hollow is so named because most of the inhabitants are Colvins. Many of the younger children do not know their last names. They identify themselves, for example, as Sadie's Bennie or Dicy's Willie.

Needles Hollow, adjacent to Colvin Hollow, is next in the scale of social development. It is reached by a

[1] From the University of Chicago. Studies of mountain people in progress under a grant from the Payne Fund of New York. Dr. Key of the Washington Child Research Center gave and tabulated most of the tests.

rocky road from a small hamlet at the base of the mountains. Its patches of ground, from two to five acres on the average, surrounding the cabins, approach the status of small farms. It is a more socialized community and many of the adults are literate. The children have had good school advantages compared to Colvin Hollow.

Oakton Hollow, next higher in the social scale, is separated from Colvin Hollow by a high mountain. The road to the valley is passable for old

FIG. 1. THE COLVIN SCHOOL HOUSE

Fords and wagons most of the year. The Hollow boasts of a combined general store and post-office and many of the inhabitants receive mail and an occasional magazine. There exists a greater social consciousness than in Colvin or Needles Hollows. Oakton Hollow has had about four months of school each year for some time. The people are fairly prosperous although they have but little surplus farm products to sell in the valley.

Rigby Hollow, culturally further developed, can be reached from the valley much more easily than any of the other three hollows. The present school was established by missionaries about nine years ago and has been conducting regular school terms. Church and Sunday School services are held regularly. The farms are larger than those of the other hollows and there nearly always is a surplus which is sold in the valley. School terms have been about seven months each year for the past eight years and approximately 75 per cent of the inhabitants are literate.

For purposes of comparison a small farm and sawmill town, Briarsville, was chosen. It is located at the base of the mountains to the south of the Hollows. The town has a hard surfaced road connecting it with the principal cities of Virginia. The school building is a modern structure with 4 classrooms, 3 of which are used regularly. The school board employs 3 well-trained teachers. The town has a

good general store, telephones, and receives newspapers.

The comparison of the intelligence test results of the mountain children with those of the children of Briarsville is especially significant in view of the origin of many of the residents of this town. Many of the inhabitants migrated from the mountains in the past to obtain work on the adjacent farms and in the sawmill. At first socially isolated from the "first" families of this town, the children now mingle freely. It was thought that a comparison of intelligence tests results of the mountain children with those of Briarsville would be much more significant than with children of an average town or city.

Intelligence tests were given to more than half of the children of the 4 mountain hollows and Briarsville. Not every child was tested, for some of the younger children could not be taken to the place where the tests were given, and a few of the others refused to cooperate. Nine tests were used: the Stanford-Binet; The National Intelligence Test, Scale B, Form 2; Pintner-Cunningham Primary Mental Test. For performance tests the following were employed: Manikin, Seguin Form Board, Mare and Foal Healy Puzzle "A," the Knox Cube Test from the Pintner-Patterson scale of performance tests, and Goodenough's Drawing of a Man.

A representative sample of the school population thus was tested. A total of 386 tests were given to the children in the mountain communities and 198 in Briarsville. The children in Briarsville were not given Stanford-Binet tests because of the difficulty in organizing the program there. One hundred two children were examined in the mountain communities and 81 in Briarsville. In addition to an investigation of test scores and mental age results, a qualitative analysis of the responses was made.

Table 1 shows the length of the

FIG. 2. A COLVIN HOLLOW FAMILY IN THEIR FRONT YARD

school term in 5 communities since 1918. The Colvin Hollow school has been the most irregular with the least number of months of schooling. Between 1918 and 1929 Colvin Hollow has had only 16 months of school at irregular intervals. It was impossible to find an exact record of the years in which school was held. Rigby Hollow has the most regular school term of the mountain communities.

The superiority of the Briarsville school system is shown not only in the greater number of months in which school was held in the past eleven years but also in the regularity of the school term.

TABLE 1

Length of school terms in months in the five communities

YEAR	COLVIN	NEEDLES	RIGBY	OAKTON	BRIARSVILLE
1918–19	16 months	?	4	6	9
1919–20		2	4	6	9
1920–21		2	4	6	9
1921–22		0	4	6	9
1922–23		4	4	7	9
1923–24		2	4	5.5	9
1924–25		2	7	6	9
1925–26		2	7	4	9
1926–27		2	7	5	9
1927–28		2	7	3	9
1928–29		5	7	5	9
1929–30		7	7	7	9
Total months 1918–1930.....	16	30?	66	66.5	108

The per cent of children retarded in school in the mountains and in Briarsville is given in table 2, taking 6 to 7 years as the age standard for first grade, 7 to 8 for second grade, and so on. Children at the grade or accelerated and those retarded more than six grades are not included. Only one child in the mountain communities was found to be in a grade higher than his chronological age warranted and thirteen were "at grade."

It is difficult to estimate age-grade retardation accurately in the mountain communities because of the loose standard of requirements for grades. Grade placement depends entirely upon the judgment of the teacher, although her estimate sometimes is obtained by a formal examination. The fact that only a few children were accelerated is not a real indication of a general lack of ability but probably means that the

TABLE 2

Per cent of children showing age-grade retardation

AGE-GRADE RETARDATION	BRIARSVILLE	MOUNTAINS
1	22	20
2	38	17
3	16	12
4	12	16
5	4	8
6	1	8

teachers do not use the same system of promotion as in a city school. Psychological tests of intelligence and achievement have never been given in these communities and there is, therefore, no way of measuring the real abilities of the children. In many cases the older children are left to their own resources in the school room as the teacher spends most of her time with the younger children.

Table 3 shows the average intelligence quotient of the children in the four mountain communities and Briarsville. The standard deviations fall within the range of reliability. The curves of distribution of scores in general were similar to those of children in an average community. The average intelligence quotient of the Briarsville children was higher than that of the mountain children in every test, and had a smaller standard deviation. The results give further evidence of the effect of systematic training upon intelligence test ratings, a factor often slighted in comparative studies of intelligence test scores.

The dependence of the intelligence quotients on the kind of test used is shown in a comparison of the average I.Q.'s of the mountain children on the different tests used. The highest average intelligence quotients are found in the tests presumably most independent of language and of school training, and lowest in those utilizing language ability.

When we examine the results of the tests in Briarsville, on the other hand, we find that while the highest average I.Q. was obtained in the performance tests, the next highest was on the National intelligence test—a test dependent upon language ability. This may be additional evidence that systematic and consistent training in a community of a comparatively high order or social organization is a stimulus to the development of the kind of intelligence we ordinarily measure by tests.

These mountain children are slow and cautious with a slow tempo of response. The way in which the environment influences a child's method of responding probably has not been studied sufficiently in intelligence test results. In scoring the results it was found that the children rated highest

TABLE 3

Average intelligence quotients according to various tests

TESTS	MOUNTAIN COMMUNITIES			BRIARSVILLE		
	Number of cases	Average	S.D.	Number of cases	Average	S.D.
Stanford-Binet	32	61.5	11.2			
National	24	61.2	17.5	50	96.1	15.2
Pintner-Cunningham	42	75.9	17.1	31	87.6	13.0
Four performance tests:						
Year scale	54	83.9	24.8	10	118.6	17.1
Med. M.A. scale	54	79.1	23.8	10	95.6	16.3
Drawing of a man	63	72.3	17.9	67	76.3	17

in those tests in which the tempo of the directions and the responses was slowest. It is not surprising to find that the children rated highest on tests which took into account least the factor of speed. The children in these mountains live in an environment which does not put a premium on speed involving abstract comprehension. This sort of failure differed in degree in the various communities. The Colvin Hollow children failed most frequently in tests involving calculation, in part because the terms used were foreign to them. The difficulty of evaluating failures on simple problems is due in

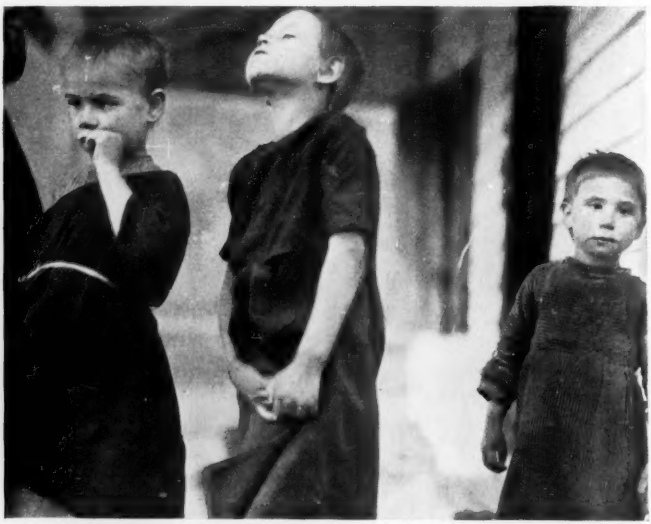

FIG. 3. THREE COLVIN HOLLOW SCHOOL CHILDREN

The majority of these children show strabismus, and one of the children shown in this picture is forced to hold his head high and to the side in order to see because of his squint.

and the problem of evaluation of their test scores thus is complicated further.

The Stanford-Binet test at once might be considered inadequate because of its evident dependence upon language and school training. Analysis of the successes and failures on this test further showed its unadaptability for studying this type of children. Failures were most evident on items part to the uncertainty of knowing whether the children failed because of insufficient language comprehension to understand the directions. Rote memory was found to be above the average of other test results, but the most common failure in Colvin Hollow was in the reversal of numbers. Following the giving and scoring of the tests a number of children were given

practice in the reversal of the number sequence 1–2–3. After it was thought that they could reverse this sequence other numbers containing four figures were given. As an example, the sequence of 6–5–2–8 was reversed by most of the children as 6–5–4–3–2–1.

The almost universal failure of the mountain children in the ball and field test indicates their lack of ability to comprehend and solve a simple problem involving foresight and planning ability. Few of the children appeared to have a plan for finding the ball in a circular field. Usually a line was drawn in the center of the diagram and in some cases this was varied by dots indicating trees. Many children of Colvin and Needles Hollows could not understand the directions of the ball and field test. They had little comprehension of the meaning of "field" and were astonished at a ball being lost. (Most of the children never had seen a ball.) One boy of 13 made a curious effort. He drew a number of small rough circles in the enclosure which he explained as representing trees. Then he drew a line from one circle to the next connecting them. He then stated that he was hunting for the lost article under the trees. In this and other cases it was very difficult to assume, as one is forced to do in scoring the test, that the failure indicates a deficiency of innate intelligence even on that one test. Although it is not assumed that a child must have experience in the performance called for on a given test, and indeed such direct experience would mitigate the significance of the score,

FIG. 4. A GROUP OF COLVIN HOLLOW SCHOOL CHILDREN IN THEIR BEST DRESS

it can be assumed that a child must have had some approximate or similar experience. These mountain children live in an environment calling for little planning and ingenuity expected of an average child of not more than nine years.

Evidently space and form differentiation as employed in these tests are relatively foreign to these children. Only one of the younger children in Colvin Hollow correctly copied the drawing of a diamond.

An impoverished environment probably acts as a depressing factor on the development of intelligence. The problem of the effect of the environment upon the development of intelligence has attracted the attention of many psychologists in recent years. Some (1) believe that the environment may act either as a stimulant or as a depressant to the intelligence of young children. Others believe that the capacity for the development of intelligence is influenced but little by the

FIG. 5. HEADQUARTERS FOR THE FIELD WORKER

The items which the children in all the hollows passed most consistently were the mutilated pictures, counting backwards from 20, arranging weights and comprehension of pictures. In 2 of the hollows most of the children could not name the days of the week in correct sequence. This failure probably was due to the fact that they have no use for differentiation of days, since one day is like the next in its significance except for the days of going to school and staying at home.

environment. It is the belief of many psychologists that some tests rate children higher at certain age levels than at others. For example, the Stanford-Binet in some cases gives the very young child a comparatively higher rating than an older child. In examinations of nursery school children over a period of about eighteen months of intensive training, it was found (3), that the intelligence quotients obtained by the Kuhlmann scale varied considerably. There was a tendency

toward homogeneity of the intelligence quotients with continued attendance in a nursery school. The range of the intelligence quotients on the first test was 87, on the second 27 and on the third 22. The duller and brighter children approached an average intelligence quotient with repeated tests on continued attendance in the nursery school. It was thought that the environment of the nursery school stimulated the duller children to develop intellectually. The brighter children, on the other hand, were not required applied to the mountain children. The decrease in the intelligence quotients in some of the tests is as great from the 6th to the 10th year as from the 10th to the 16th year. In some cases the decline in intelligence for children over 10 is greater than for children between 6 and 10. An intelligence test is an indirect measure. An estimate of intelligence is based on the information the child has been able to obtain. In the mountain environment increments of information become less large with increases in age, and the seven-year-

TABLE 4

*Average intelligence quotient on five tests according to increasing chronological age**

CHRONOLOGICAL AGE	NUMBER OF CASES		PINTNER-CUNNINGHAM		NATIONAL INTELLIGENCE		DRAWING OF A MAN		PERFORMANCE SCALE			
									Year scale		Med. M.A. scale	
	Mountains	Briarsville	Mountains	Briarsville	Mountains	Briarsville	Mountains	Briarsville	Mountains	Briarsville	Mountains	Briarsville
6–8	12–13	8	84	94			80	93	91		89	
8–10	15–23	4–22	70	91		117	66	82	84	119	76	93
10–12	5–16	5–20	53	76	66	101	71	69	86	108	70	87
12–14	7–12	16			67	91	69	73	83		83	
14–16	8–15	14			52	87	49	70	75		73	

* The figures indicating the number of cases does not mean that every test was given to the numbers indicated. The minimum and maximum number of children given a test at the respective chronological ages is shown.

to develop further. A similar factor probably influences the development of the mountain children. Adjustment in the mountain hollows does not necessitate a high intelligence level. Intellectual development therefore becomes increasingly less rapid with increase in chronological age.

Table 4 gives the average intelligence quotients on various tests according to increasing chronological age. It shows a decrease in intelligence quotients with increase in chronological age for every test except the National, old has relatively more chance to gather information and to learn by experience than the twelve-year-old in the same environment.

In a study of Kentucky mountain children Hirsch (2), concluded that the slow decline of the intelligence quotient in the age groups tested was due for the most part to environmental factors.

Table 5 shows the per cent of cases below the average intelligence of the four mountain communities studied. The table shows, with some slight vari-

TABLE 5

Per cent of cases below the average intelligence of the four mountain communities

TESTS	COLVIN	RIGBY	NEEDLES	OAKTON	BRIARSVILLE
Stanford-Binet	84	25	64	50	
Pintner-Cunningham	66	22	66	50	19
National intelligence		61	36		0
Drawing of man	100	29	63	60	47
Performance tests:					
Year scale	70	47	59	25	10
Med. M.A.	80	46	47	62	0

TABLE 6

*The relation of intelligence quotients to size of family in Briarsville**

NUMBER OF SIBLINGS	NUMBER OF FAMILIES	NUMBER OF CHILDREN TESTED	AVERAGE INTELLIGENCE QUOTIENTS		
			Pintner-Cunningham	National intelligence	Drawing of man
11	1	4	74	87	72
10	6	19	76	91	69
9	2	5	85	98	80
8	1	4	106	99	78
7	3	11	90	93	81
6	4	9	91	103	78
5	5	10	89	93	74
4	7	8	109	97	81
3	6	7	97	112	80
2	3	4	87	86	73

* Not all the children were given every test indicated in the columns.

TABLE 7

*The relation of intelligence quotients to size of family in the mountains**

NUMBER OF SIBLINGS	NUMBER OF FAMILIES	NUMBER OF CHILDREN TESTED	AVERAGE INTELLIGENCE QUOTIENTS				
			Pintner-Cunningham	National	Drawing of man	Performance tests	
						Year scale	Med. M.A. scale
11	1	7	90	77	54	94	95
10	2	5	108	57	83	115	103
9	5	8	69		60	71	64
8	6	16	74	55	62	88	79
7	6	13	69	37	67	71	85
6	6	7	84		67	68	65
5	7	15	66	74	73	77	66
4	5	8	78	61	76	85	87
3	3	6	81	63	69	74	75
2	3	5	83		67	81	81
Total....	44	90					

* The test scores of only children are not shown. Not all the children were given all the tests indicated in the columns.

ation, that the per cent of cases below average intelligence increases with the decrease in the cultural level of the community. In Colvin Hollow, socially lowest in the group, the per cent of cases below average intelligence is considerably greater than in any of the other communities. Briarsville, the highest community culturally, had the smallest percent of cases below average with one exception. When each community is ranked according to the per cent of cases below average intelligence and an average rank obtained for the various tests, Rigby Hollow is second, Oakton Hollow third and Needles Hollow fourth.

Table 6 shows the distribution of intelligence quotients on three tests in relation to the size of the family in Briarsville. There is no consistent relationship between the size of the family and the average intelligence quotient. If these tests rate the intelligence of children fairly, it may be inferred that the size of the family has no effect on the intelligence of the children, but there are many arguments against such an interpretation. The children tested were not all of the same age. Since we have found that the intelligence rating of the mountain children depends upon the age of the child, the relationship between the size of the family and intelligence is not clear.

Table 7 shows the relation of intelligence quotients on four tests to the size of mountain families. There is little difference between the mountain and Briarsville children in the relationship between the size of the family and the intelligence quotients of the siblings.

SUMMARY

The results of the intelligence tests of mountain children living in varying degrees of isolation appear to corroborate the belief of many psychologists that the expression of intelligence, as measured by standardized tests, depends in a large measure upon the opportunities to gather information and upon the requirements made upon the individual by his environment. Since the ancestry of the children of all the Hollows came from the same stock the claim cannot be made that some of these mountain people are "degenerate" and therefore their children are expected to be retarded intellectually, a claim too often advanced for the supposed inferiority of isolated mountain children. Furthermore, as has been shown in this paper, the young children of the various Hollows do not differ greatly in intelligence, whereas great differences are found between the older children of the different Hollows. The only plausible explanation of the increasing difference with increasing age is that children develop only as the environment demands development. The Corbin Hollow environment is as stimulating to the child of four or five as that of Oakton or Rigby, but Corbin Hollow requires relatively little more of its older children whereas Rigby Hollow requires an ability for social adjustment met only by a high order of intelligence.

Finally, not only are the children of the communities of lower order of social development without adequate social stimuli but they also have few conflicts to spur them to attainment. A careful study of the conflicts of the

children of the different communities has shown that there is a direct relationship between conflicts and the development of intelligence as shown by tests, whether or not the relationship is causal. As these mountain communities ascend the scale of social organization and complexity the number of conflicts of the inhabitants increases also. The intelligence of the children also is highest in the communities highest in the scale of social development and lowest in the communities of lowest social development.

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From Reflex to Muscular Control in the Assumption of an Erect Posture and Ambulation in the Human Infant

MYRTLE B. McGRAW

THE assumption of an erect posture and ambulation stand out as milestones in the phylogenetic development of the human race and the ontogenetic development of the human individual. It is customary to define the transitional stage from the mammalian to the human specie as that period when the animal began to stand and walk erect. Comparably, the transition from infancy to early childhood in the growth cycle of the individual is conveniently determined by the age at which the child begins to stand erect and walk alone. The fundamental principles governing these changes and modifications in the infant's acquisition of walking are essentially the same as the principles governing all behavorial growth in infancy and probably throughout life.

The emergence of standing and walking ability on the part of the infant has ever been of extensive general interest but in recent years it has assumed considerable scientific significance since it is claimed that accelerated development in these and similar traits is symptomatic of superior endowment. Everyone familiar with standardized tests and scales for measuring infant development—such as Gesell, (3) Linfert and Hierholzer (5), Hetzer and Wolf (4), Figurin and Denisoff, (2) and Bayley (1)—knows that such items as "sitting with help," "standing with help," "standing alone," "stepping movements," and "walking alone" occupy a conspicuous portion of the scales purporting to measure infant development. However, after more than ten years of such standardized tests and established norms even the child specialists are unable to explain satisfactorily why one perfectly normal infant should walk alone at nine months and another not until he is eighteen or twenty months old. Nor are they able to evaluate adequately the significance of these individual differences. Will the one infant walk any better when he is ten years old than the other and does it follow that he will display mental superiority?

Much of the difficulty arises from the fact that attention has been centered on determining *when* particular characteristics appear without proper analysis as to the process or the means whereby they are acquired. For example, "standing with help," "stepping movements," or "walking

with help" are items which appear in the scales anywhere from eight to twelve months. Yet it is an established fact that many newborn infants when supported at the axillae or when held merely by the hands will sometimes rest their body weight on their feet and will take prancing or walking steps. To be sure, the way the ten day old infant stands or walks with help is qualitatively very different from the way the ten month old infant performs this function. However, infant scales of development cannot attain maximum usefulness until these distinctions have been brought into relief. It would seem that the infant's inability to walk at birth is due more to an undeveloped equilibratory apparatus than to the absence of a walking mechanism. A primitive or vestigial mechanism is there, but it appears to be segmental and not integrated with related functions essential to upright ambulation.

In order to walk upright an individual must be able to support his weight, maintain his balance, and propel himself forward. The flexion and extension of the lower extremities at the two major flexion foci functions at birth and the big task ahead of the infant is to develop a resistance to and a control over the force of gravity. Most "partunates"[1] display a decidedly helpless response to the force of gravity. When raised from a supine to a sitting position his reaction usually is distinctively flaccid and he falls helplessly forward into a closed-jack-knife position. From all observable indication he is quite comfortable in that position. A few days later, however, he will show a slight resistance to this forward fall, will free his lower extremities from flexion beneath his body, thereby getting himself into a prone position, and occasionally the head may bob off the surface on which he is lying. With progressive development, increments in this resistance to gravity is quite evident (first in the region of the head and neck and then the trunk) until finally the baby is able to support himself a little while in an open-jack-knife position. Still later he can support himself in an upright sitting position though he is unable to get into that position without help. Finally he can not only resist gravity sufficiently to maintain a sitting posture, but he can carry the superior portion of his body counter to the force of gravity in order to attain a sitting position. The ability to ues his lower extremities against the force of gravity develops a little later. It is observed that the infant's increasing ability to counteract gravitational forces is exceedingly gradual in development and it has a cephalocaudal trend.

The reaction of the partunate when held in an upright position, supported at the axillae, is usually in keeping with his general picture of flaccidity. Ordinarily the lower extremities flex and abduct beneath the body. A few partunates and most neonates will occasionally extend their lower ex-

[1] A term indicating infants who are just born. Although it is not limited to a definite number of minutes it covers about the first fifteen or thirty minutes of life since it includes the time during and immediately following parturition. When the umbilical cord is dressed and the baby is taken to the maternity nursery, then he becomes a "neonate."

tremities and momentarily help support their body weight, as previously mentioned, or they will make prancing or walking steps. The posture of the infants when making these steps seems to have developmental significance: The spine is held vertical to the substratum. There is an exaggerated flexion at the two major flexion foci of the lower extremities, namely, the hips and the knees. Locomotion is of the digital grade and usually of the scissors type, not unlike that of the spastic paraplegia suffering a lesion in the spinal portion of the pyramidal tracts. The upper extremi-

FIG. 1. Flaccidity of "Partunate" manifest in the dropping of the head toward the spine and an extension of the spine when the infant is raised from a supine to a sitting position.

FIG. 2. Older infant displays a tendency to flex the head and neck toward the chest, to flex the trunk slightly; the lower extremities are raised off the surface and the infant helps in rising from a supine to a sitting posture.

FIG. 3. Infant has sufficient power to raise her head (but not the trunk) off the surface in an effort to get from a supine to a sitting position.

FIG. 4. An older infant has sufficient power to push his trunk as well as the head and neck against the force of gravity in order to get from a supine to a sitting posture.

ties are ordinarily flexed and adducted, apparently unassociated with the propulsive movements of the lower extremities. At a later stage it is observed that the flexion at the knee has greatly decreased although there is a marked flexion at the pelvis, rendering the posture similar to that of the anthropoid gibbon. Locomotion is still of digital grade though less of the scissors type. The crossing of the extremities is pedal, rather than on the legs, and stepping movements are less distinctly prancing in type. By and by the stepping movements tend to disappear and the infant, though retaining more or less the anthropoid posture, engages in a sort of rhythmical jumping. When stepping movements, a few weeks later, reappear they show some tendency toward plantigrade, and, although the lower extremities are still held anterior to the trunk, functional use of the ankle joint as one of the flexion foci is emergent. Further growth tends to bring the trunk and lower extremities into a plane perpendicular to the surface and locomotion becomes more positively plantigrade. Early standing and walking alone are associated with a marked unsteadiness or dyssynergia and final development of the function of an erect posture and ambu-

FIG. 5. Flaccidity of "Partunate" demonstrated by this "jack-knife" position assumed when the infant falls forward from the sitting position and shows no resistance to the force of gravity in making this fall.

FIG. 6. An infant a few days old will free his lower extremities when pinioned beneath his body.

FIG. 7. With further development an infant will support himself in a slightly "open-jack-knife" position.

lation is noted by a lessening of this dyssynergia and an increasing control and certainty on the part of the infant.

In so far as the development of an erect posture and locomotion in infants adheres to the general laws of functional growth the following interpretations and conclusions seem warranted:

(1) Certain types of activities appear to function on a reflex level before they become a part of a controlled muscular pattern. The reflexes tend

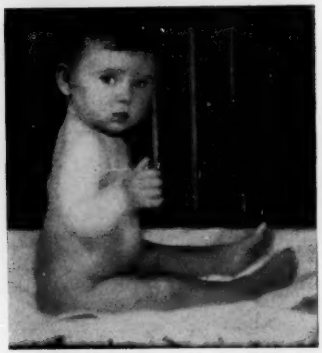

Fig. 8. Development is gradual and continuous until infant can sit perfectly erect though she cannot get into the sitting position.

to disappear before or about the time the controlled neuro-muscular pattern emerges. For example, there is a diminution of the early reflex stepping movements before the controlled process of walking becomes a part of the infant's behavior repertoire.

(2) There is no evidence of a sudden emergence of a new totally integrated pattern. That is to say, the infant does not use one distinct pattern of response and cast it off for the use of another pattern when a new phase in his development has become evident. Rather the new pattern unfolds, bit

Fig. 9. Flaccidity of "Partunate" shown by the flexion and abduction of the lower extremities, upper extremities flexed and adducted and the neck is flexed so that the chin rests on the chest.

Fig. 10. Infants a few hours old will when supported at axillae frequently make prancing steps. They are usually of the scissors type. Note the hyperflexion at the knees and hips, the adduction of upper extremities, and the trunk which is almost vertical to the substratum.

by bit, and dovetails with the old pattern and gradually the new pattern becomes more and more dominant

until finally it is superimposed upon the old pattern though in times of stress and strain the infant will revert to the less mature response.

(3) Growth in the assumption of an erect posture and walking is extraordinarily gradual. Although the acquisition of the power of walking erect is obviously dependent upon a degree of maturation or ripening of the nervous system it nevertheless has the essential elements involved in a learning process. In acquiring any

FIG. 11. Note less flexion at knee joint—anthropoid posture; digital progression; and slight abduction of upper extremities, and progressive steps are disappearing.

FIG. 12. Infant beginning to stand without support. Note that lower extremities and trunk are now in the same plane; upper extremities are abducted in helping to maintain balance.

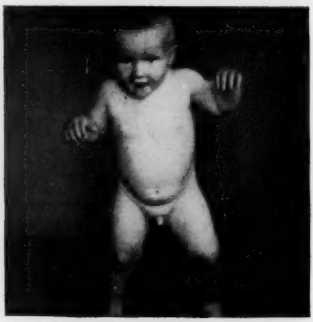

FIG. 13. Emergence of plantigrade walking steps. Progressive steps in upright posture but maintenance of balance is still quite unsteady.

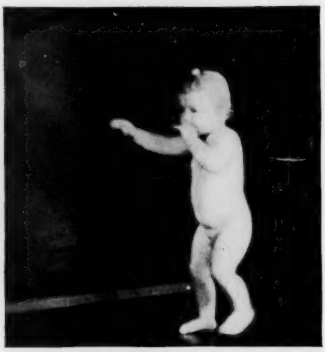

FIG. 14. Infant now has considerable control over the process of walking. Note the use of the upper extremities and the evidence of associated movements in the right upper and left lower extremities.

new reaction pattern the infant experiences a degree of uncertainty or dyssynergia. A decrease in this dyssynergic aspect associated with a particular reaction pattern and an increase in the precision and of the performance is unquestionably a type of learning. Such learning is not, however, of the trial and error, or analysis and selection, variety. For the infant, behavior development is not so much a question of eliminating false responses and selecting satisfying ones as it is an increase in the degree and precision of response, the initial pattern of which is the desirable. Infants tend to make a partial response rather than a false one and "learning" consists of a completion of the reaction pattern rather than selection and elimination of responses.

(4) Standardized tests and scales for measuring infant development can be of little practical value until these phases in the development of a single trait have been minutely analyzed and determined.

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The Development of Language in Twins

II. The Development of Twins: Their Resemblances and Differences[1]

ELLA J. DAY

INTRODUCTION

MAN'S curiosity in the unusual has led him into many fields of adventure. Twins, constituting about one per cent of the births according to Davenport (3) are both so rare and so different that science has for a long time been very curious about their origin, their resemblances and their differences. The dispute as to the relative importance and effects of heredity and environment in moulding human nature dates back to the ancient Greek philosophers and scientific workers always have felt that twins presented a special opportunity for making such studies.

Newman's (16) investigations on the star fish and the Texas armadilla as well as his more recent studies of twins, point unquestionably to the fact that there are 2 types of twins. The identical or monozygotic twins arise from the splitting of a single zygote while the fraternal or dizygotic twins arise from the simultaneous development of two zygotes. The psychological studies of twins beginning with that of Galton (4) in 1883 also give evidence of the two types of twins, in that they show a greater degree of resemblance in both physical and mental traits in identical twins than in fraternal twins. Thorndike (19) in 1905 disputed this fact. The later investigations of Merriman (14), Lauterbach (12), Gesell, (5, 6), Muller (15) and Wingfield (22) however have all supported the theory of the monozygotic origin of identical twins.

This investigation, though undertaken primarily to compare language development in twins with that in single children, also obtained sufficient information in regard to the twins studied to determine fairly accurately whether or not they were identical or fraternal twins. With these data at hand, the three types of twins, identical, like-sex fraternal and unlike-sex fraternal were compared as to resem-

[1] From the Institute of Child Welfare, the University of Minnesota. The Development of Language in Twins, Part I, A Comparison of Twins and Single Children appeared in Child Development (Vol. 3, No. 3). It reported the language development of 80 pairs of 2 to 5 year old twins and compared their development with that of the single children reported by D. A. McCarthy (13) in The Language Development of the Preschool Child. McCarthy's method and technique were repeated throughout. The tables of Part 1 and 2 are numbered continuously.

blances and differences in language attainment, mental test performance and certain physical characteristics.

Subjects

Eighty pairs of twins, 20 at each age level, 2, 3, 4, and 5 years, were selected on the basis of sex and occupational class. Like-sex twins were selected in preference to unlike-sex twins in an effort to obtain a larger number of identical twins in the group. Table 5,[2] shows the distribution of cases by age, sex and type of twin.

The percentage of both identical (23.75) and unlike-sex twins (28.75) is low for a representative sampling of the twin population. The like sex fraternal group is proportionately high.

TABLE 5

Distribution of cases by age, sex and type of twin

TYPE OF TWIN	2 YEARS		3 YEARS		4 YEARS		5 YEARS		TOTAL	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Pairs	Per cent
Like sex identical	8	10	2	4	2	6	4	2	19	23.75
Fraternal	8	6	10	8	12	10	10	12	38	47.50
Unlike sex	4	4	8	8	5	5	6	6	23	28.75

Procedure

Information in regard to the development, likenesses and differences of the twins was obtained largely by means of a questionnaire. This was filled out in consultation with the mother at the same time that the language record was obtained.

Information about the family included parents' birthplaces, education, and occupation; names, and ages, and age of talking of other children; foreign language spoken in the home; policy of the family with regard to speech of the twins; age, sex, and speech of the twins' playmates; leadership and emotional habits of the twins; and whether the family considered them identical.

Specific information obtained on each twin included physical defects, sensory handicaps, serious illnesses, age of walking, talking, first tooth, handedness, thumb sucking, and other nervous habits, play interests, self-help in eating, dressing and toilet habits, and hair and eye color.

In addition to this information records were obtained, where possible, from the hospital or physician, as to the number of placentae reported at the delivery of the twins. Later, when the question arose as to the possible relationship of prematurity of birth to the apparent mental retardation of the twins, a questionnaire was sent to the mother, asking for the following information: Order of birth of the twins, whether or not the twins were born at full term and if not how much they varied from it, whether or not twinning had appeared in any of the relatives of the mother or the father. Seventy of the 80 parents, or 87.5 per cent replied to this questionnaire.

[2] Tables are numbered consecutively from Part 1.

THE MENTAL DEVELOPMENT OF THE TWINS

The language retardation of the twins, evident in every method of analysis, suggests at once, the possibility of a similar mental retardation. Merriman was the first to use the present day intelligence test as a device for measuring mental ability of twins and so he was the first one to report I.Q.'s on a large group. Although he found the mean I.Q. of 105 pairs to be 96, he assumed that the slight retardation was due to selection of cases and was not to be interpreted as indicating mental inferiority of twins as a whole. Wingfield (22) on the contrary, concluded from his study, that twins were from 1 to 2 per cent below average in intelligence.

INTELLIGENCE OF THE TWINS

The twins of the present study were given the Minnesota Pre-school Scale[3] as described in Part 1. Test scores were obtained on only 123 of the 160 children. In a few more cases, tests were attempted but a satisfactory test was not obtained. The remainder of the group failed to coöperate to the extent of allowing the tests to be given. The range of I.Q.'s for the twin group was from 59 to 138.

Table 6 shows the mean I.Q.'s by age and sex of the twins and singletons.

It may be seen, as has been pointed out previously, that the twin group is consistently below average, with the exception of the two year old and five year old girls. The singleton group, on the contrary, are slightly superior, except at the three year age group which is approximately average. The tests used in the two instances were not the same. The singletons were given the Kuhlman-Binet test and the twins were given the Minnesota Pre-school Scale (9). However this scale is composed largely of the individual tests from the Kuhlman and Stanford-Binet tests; hence the actual items of each test do not differ greatly. Boys are inferior to girls at every age in both groups, except at three years. Since the selection of the two groups is so nearly identical, the evidence points rather directly toward slight inferiority of the twin

TABLE 6

Mean I.Q. of twins and singletons by age and sex

C.A.	TWINS					SINGLETONS (MC CARTHY)		
	Boys		Girls		All—Mean I.Q.	Boys—Mean I.Q.	Girls—Mean I.Q.	All—Mean I.Q.
	Number of cases	Mean I.Q.	Number of cases	Mean I.Q.				
years								
2	14	89.0	11	103.0	95.0	102.4	109.4	106.9
3	15	95.0	18	93.0	94.0	100.5	97.7	99.3
4	18	90.0	17	92.0	91.0	101.8	103.8	103.8
5	14	95.0	16	101.0	98.0			

[3] This scale was in the process of standardization at the time this investigation was made.

group in general intelligence as it was measured.

Not only are the upper occupational groups superior to the lower occupational groups in each cases, but the lower occupational group of singletons is superior to the upper occupational group of twins. A similar situation was apparent in regard to mean length of language response. The slight differences in the percentage of each population, taken from the upper and lower occupational groups, favors the twin group. Exactly 50 per cent of the twin group fall in the three upper groups as compared with 47.1 per cent of the singleton group.

The most interesting evidence in regard to the intellectual inferiority of twins may be seen by a comparison of the findings of the various twin studies. (See table 7) Here the data from the Wingfield, Freeman[4] and Merriman studies have been assembled and to some extent reworked, from their original data, to get the desired means. This group of studies, including the present study, represent a total population of 737 twin children of 368.5 pairs. The range in age is from two to about sixteen years. The intelligence tests used have been standard tests. Only one mean I.Q. in the table is as high as 100 or above, and that is for the 50 pairs of identical twins examined by Freeman. In addition to those data, the Lauterbach data give a mean I.Q. of 95 for that twin group. This adds about 200 pairs of twins to the population considered, making a total of 568 pairs. The mean I.Q. for this entire group of 568 pairs of twins is 96.3. Such a sampling as this, showing consistent mean I.Q.'s from 1 to 6 points below the average I.Q. of 100, for the population as a whole, is surely sufficient evidence to confirm Wingfield's conclusion, that twins are, as a group, slightly below the average in intelligence as measured.

TABLE 7

Mean I.Q. of like-sex and unlike-sex twins as found by the different investigators

	DAY		WINGFIELD		FREEMAN		MERRIMAN		TOTAL	
	Number	I.Q.	Number	I.Q.	Number	I.Q.	Number	I.Q.	Number	I.Q.
Like sex	88	93.5			200	98.8			288	97.2
Identical	27	99.7	90	99.0	100	101.6	44	98.0	261	99.9
Fraternal	61	90.8	62	92.9	100	96.1	90	96.2	313	94.5
Unlike sex	35	96.2	52	98.6			76	94.7	163	96.3
All fraternal	96	92.8	114	95.7			166	95.5	376	94.9
All twins	123	94.3	204	97.2	200	98.8	210	96.0	737	96.8

COMPARISON OF THE INTELLIGENCE OF IDENTICAL LIKE-SEX

Fraternal and Unlike-sex twins

Dr. Freeman in making a preliminary report of the twin study being conducted at the University of Chi-

[4] Investigation now under way in collaboration with Newman and others at University of Chicago. These figures came from mimeographed notes presented by Dr. Freeman at a lecture.

cago, called the attention of the writer to the possible differences in mean I.Q. between identical and fraternal twins. In order to obtain such information in regard to the groups studied, by the other investigators, their original data were worked over. Wingfield and Freeman distinguish their twins as identical, like-sex fraternal or unlike-sex. For the Merriman study, a group denoted, "reported as very similar" in appearance were selected by the writer as the nearest approach to an identical group. The necessary original data for the Lauterbach study could not be obtained. In the Thorndike group, 11 pairs, who from the data on physical measurements appeared to be most nearly alike were selected as possible identical twins. Those data did not give I.Q.'s but the mean deviation from the mean of the composite score, for all tests given, was used as denoting the relative standing of the various types of twins.

Table 7 shows that in every group the identical twins were superior to the fraternal twins and most nearly approached the average of the population as a whole. The total sampling represented is about 130 pairs. Merriman shows a lower mean I.Q. for the identical group than is shown by any other study. It must be remembered, however, that this group is less carefully selected and so very probably includes some fraternal twins. Moreover, his fraternal group very possibly includes some identical twins. The fraternal group, including like and unlike-sex twins, drops from 2.5 to 7.0 points below the identical group in I.Q. This group comprises 238 pairs of twins.

In the Thorndike data the differences are in the same direction. (See table 8.) The fraternal group score slightly below the mean for the entire group and the identical twins score considerably above this mean.

If the data presented by these various studies are on a representative sampling of twins, the consistency of the findings is evidence of a real difference in intelligence between identical and fraternal twins. The cause for such a difference brings up biological problems of great interest. Two of the factors suggested, as possibly entering into such a difference, are the mean occupational class represented by each group and the question of prematurity. Such data were available only for the twins of this study and are presented in table 9.

TABLE 8

Mean deviation score of twins (Thorndike)

	NUMBER OF CASES	MEAN DEVIATION SCORE
Like sex:		
Identical	22	+791.77
Fraternal	34	−26.35
Unlike sex	14	−126.57
All fraternal	48	−55.58

The occupational class differences favor the identical twins by .3 of an occupational class. It would be interesting to know whether or not the tendency for twins to develop from a single zygote is more prevalent among the upper classes than in the lower classes. The sampling is too small in

the present study to make sure that this difference is not due to selection. It is to be hoped, that in the future investigators will note the occupational class of the subjects.

The Goodenough (8) evaluation of the Kuhlman-Binet test was based upon 300 cases very carefully selected from the standpoint of occupational class. Goodenough says, "The differences between the mean I.Q. earned on the first examination by the children of parents belonging to the professional classes, and the corresponding rating for the children of day laborers amounts to approximately one and one-fourth standard deviations of the total distribution of I.Q.'s for the entire group." Goodenough's findings in this regard are in close agreement with the results of the army intelligence tests and those of Haggerty and Nash (11) based upon an examination of 6,688 New York State School children. The difference of .3 of an occupational class found in this study between the identical and fraternal groups, is no doubt a factor in causing the differences found between these groups in I.Q. It is, nevertheless, a question as to whether it is entirely accountable for the difference.

TABLE 9

Mean I.Q., occupational class and period of gestation like-sex and unlike-sex twins

TWINS	MEAN I.Q.	OCCUPATIONAL CLASS	PERIOD OF GESTATION
			weeks
Like sex:			
Identical	99.7	3.4	36.1
Fraternal	90.8	3.9	38.5
Unlike sex	96.2	3.5	39.9
All fraternal	92.8	3.7	39.2

It is a well known fact that twin births constitute a large proportion of the premature births. This is one factor in their high rate of mortality at birth. Capper (1) in an investigation of 437 immature infants, found that 72 per cent of them were born prematurely. Fourteen per cent of those born prematurely were twins. The mean period of gestation for 68 pairs in the present study was 38.4 weeks or 269 days. This is not apparently a startling variation since Capper says, "In obstetrics a mature infant is one born at term, i.e., at the end of from 270 to 290 days, irrespective of the degree of the development of the baby."

Table 9 shows that the identical group have the lowest mean period of gestation and are approximately one month premature. They are, however, the group with the highest mean I.Q. A correlation (Pearsonian r) of $+.03 \pm .067$ was obtained between I.Q. and the period of gestation for 102 twins. The correlation between birth weight and the period of gestation was found to be $-.44 \pm .054$ and between birth weight and I.Q. $+.05 \pm .062$. Since there is little relationship between, either the period of gestation and I.Q. or the birth weight and I.Q., prematurity cannot be a very significant factor in causing the differences in I.Q. between identical and fraternal twins. Gesell (7), in discussing the growth of the premature infant, says, "The maturation of the

central nervous system is perhaps least affected by the condition of prematurity. The head of the premature infant continues to grow in size at a relatively normal rate, even when his general bodily development is distinctly subnormal."

EFFECT OF LANGUAGE UPON THE MENTAL TEST SCORE

Thirteen of the 29 individual tests included in the Minnesota Pre-school Scale at this time, required a verbal response. Since the twins as a group were 6 points below average in I.Q., the question arose as to whether the intelligence test score had not been reduced by the twins' handicap in language. In order to check this point, the four year old group, which had a lower mean I.Q. than any other age group (91.), were matched with a control group of single children. Mental tests had been obtained on 35 of the four year old twins. These were matched as closely as possible with other cases, who had been given the same test. They were matched in regard to total test score, chronological age at time of testing, sex, and occupational class.

Table 10 shows the means of the various aspects matched, which were found for the two groups. It also shows the mean raw scores and percentage scores, determined separately, for the 13 verbal and the 16 non-verbal test items. These could not agree much more closely. It seems to the writer to show that the Minnesota Scale requires a minimum of language, as it was planned to do. At least, single children, who it has already been pointed out, have superior language ability, did not in this instance use their language ability any more effectively than did the twins. The language retardation of these four year old twins, does not seem to have been a factor in reducing the total test score and thus lowering the I.Q. It may be pointed out, however, that the test did not give an opportunity for the maximum use of language.

TABLE 10

Mean intelligence test score, age and occupational class of four year old twins and control group

	TWINS—MEANS	SINGLETON (CONTROLS)—MEANS
Occupational class	3.9	4.1
Chronological age*	4–2–3	4–2–7
Total test score	103.37	103.60
Raw verbal score	47.4	47.0
Raw non-verbal score	56.0	56.6
I.Q.†	90.7	93.6
Percentage verbal score	46.3	45.4
Percentage non-verbal score	53.7	54.6

* C.A. is stated in years, months and days.

† The apparent discrepancy in the differences found in I.Q., although the total test score and C.A. are the same is due to the fact that as the Minnesota Scale was still in process of standardization, the raw point score had not yet been transferred into equivalent scale values.

The relation between the language development and intelligence may be seen by the series of correlations presented in table 11. The Pearson product moment method of correlation was used.

It may be seen, that the McCarthy four year old singletons show a small positive correlation between length of

response deviation from the mean and I.Q. whereas the twins, of this age, show practically no correlation. Twins at 2, 3, and 5 years, however, show similar correlations of +.43 between mean length of response and 2 years 14.75, 3 years 12.83, 4 years 9.19, 5 years 14.00.

The four year old group, for some reason, shows a fairly high negative correlation (−.57) between the total score on the intelligence test and the

TABLE 11

Correlations between measures of language development and measures of intelligence

TRAITS CORRELATED	TWINS			SINGLETONS		
	Number of cases	r	P.E.	Number of cases	r	P.E.
I.Q. and mean length response 2 years	25	+.42	±.11			
I.Q. and mean length response 3 years	33	+.43	±.09			
I.Q. and mean length response 4 years	35	−.07	±.11			
I.Q. and mean length response 5 years	30	+.43	±.10			
Four-year age group:						
I.Q. and verbal score	35	+.40	.10			
I.Q. and non-verbal score	35	+.64	.07			
Mean length response and verbal score	35	−.04	.11			
Mean length response and non-verbal score	35	−.13	.11			
Length of response deviation from mean and I.Q.	35	−.08	.11	20	+.37	±.13*
Verbal and non-verbal scores	35	+.63	±.07	35	+.61	±.07†
Total test score and per cent verbal score	35	−.57	±.08	35	+.09	±.11†
Total test score and per cent non-verbal score	35	+.55	±.08	35	+.08	±.11†
Five-year age group:						
Total test score and per cent verbal score	30	+.01	±.12			

* Mc Carthy singletons.

† Control four-year old singletons.

I.Q. The lower, or practically zero, correlation of the 4 year old group, in this instance, is probably affected by the smaller standard deviation of I.Q.'s. The standard deviations of the distribution of I.Q.'s are as follows:

percentage of verbal score. Both the control group of singletons and the five year old twins show approximately a negative correlation between these same scores. It appears to be true, for these four year old twins, that

the lower the proportion of verbal score, the higher the total test score although such is not the case for five year old twins. It is open to question then, as to whether the relationship found in the four year old twins is to be interpreted as typical for twins in general, or whether it may be attributed to some phenomenon of this particular group of twins or what is perhaps more probable, of the test used.

COMPARATIVE RETARDATION OF TWINS IN LANGUAGE DEVELOPMENT AND GENERAL INTELLIGENCE

In order to compare the language retardation of the twins with their retardation in general intelligence, the mean length of response was converted into a language quotient. To do this the mean length of response of singletons for each age group was assumed as 100 or average. This involves error, since the McCarthy study is based upon only 20 children at each age. However, no other data were available.

The language age was determined by the following formula:

$$S : \text{"C.A."} :: T : X$$

"S" = the mean length of response for the singletons of a given age.[5]

"C.A." = the given age.

"T" = the mean length of response of the twins for the given age.

"X" = the language age.

$\frac{X}{\text{C.A.}}$ = the language quotient (L.Q.).

Table 12 shows the comparative retardation of twins in language development and general intelligence in terms of L.Q. and I.Q. The language retardation is so significantly greater, that factors other than "below average general intelligence" must be responsible for it. The language quotient decreases rapidly as age increases in spite of the fact that the intelligence quotient does not. Nevertheless, this increasing difference is not accompanied by a decreasing relationship between the two factors since the correlations between mean length of response and I.Q. show no consistent trend with age.

The twin situation differs markedly from the situation of a single child in but one respect and that is companionship. This difference begins in fetal life and is an environmental factor. It will have to be left for the biologists to tell whether or not, the development of two embryos may limit or reduce the inherited traits, and in what particulars. The differences between the mental ability of identical and fraternal twins suggests a nutritional difference in embryo. Since there are twice as many fraternal twins as identical twins, they would tend to pull down the mean I.Q. for twins as a whole, keeping it below 100. Aside from the possible inheritance of imperfect physiological factors concerned with speech, it seems more probable to expect the environmental factor to

[5] This figure (4.7) at 5 yrs. was taken from the Smith investigation. Her mean lengths of response at all ages agreed closely with the McCarthy findings. Smith, M.E. An Investigation of the Development of the Sentence and the Extent of Vocabulary in Young Children. Univ. of Iowa, Studies in Child Welfare, 3, No. 5. Iowa City, 1926. 92 pp.

have a limiting effect. One surely could not learn as much or as rapidly, from companionship with an individual so nearly on his own plane, as from one who was in advance. Satisfactions from this companionship may be adequate to the twin, whereas the single child may be motivated to gain his satisfactions from a wider field.

THE RESEMBLANCE OF THE TWINS

Basis for the selection of identical twins

The information obtained about the placentae proved to be too indefinite, in most cases, to be reliable. Likeness in hair and eye color and general appearance were found to be a more adequate basis for determining the identical twins. There were but five doubtful cases. One pair of girls, were finally classed as identical, as the only difference in them was a slight difference in size. The other four were all classed as fraternal due to slight differences in appearance.

The proportion of each type of twin having both identical hair and eyes is shown in Table 13. In approximately 50 per cent of the entire group these were similar although in only about 24 per cent, the identical group, was the appearance of the children also identical.

The development of the twins

The prematurity of the twins was discussed in connection with its relation to mental development. The mean birth weight was 2595.46 grams with a mean period of gestation of 269 days. The birth weight figures were taken from the mother's report. The hazard of this birth weight may be seen by Capper's statement, that of the 437 records of immature infants 145 weighed from 2,001 to 2,500 grams. The mortality of this group was 32 per cent by 6 years. The average birth weight for the population as a whole is between 3000 and 3500 grams.

Of the 68 pairs who had older brothers and sisters 42 per cent were reported by the mother as developing

TABLE 12

Comparative retardation of twins in language development and in general intelligence

	MEAN			
	2 years	3 years	4 years	5 years
Intelligence quotient	95.0	94.0	91.0	98.0
Language quotient	83.5	73.7	68.2	68.0

TABLE 13

The proportion of twins having identical hair and eyes

	NUMBER OF PAIRS	PER CENT OF TWIN GROUP	PER CENT OF LIKE HAIR AND EYE GROUP
Identical	18	94.7	46.2
Like sex fraternal	15	39.5	38.4
Unlike sex	6	26.1	15.4
All twins	39	48.75	

more slowly physically than the other children, 46 per cent were reported as developing about the same and 12 per cent faster than the older siblings. In the three twin groups, 35 per cent of the identicals developed more slowly than older siblings, 45 per cent of the fraternals were slower, and 39 per cent of the unlike sex.

The development of the twins in learning to talk and walk, and in cutting the first tooth is shown in table 14. The identical group shows a slight minus deviation from the mean in age of talking and walking but a plus deviation (.3) in age of cutting the first tooth. The like sex fraternal group show a plus deviation from the mean in all three activities. The unlike-sex twins show a plus deviation from the mean in age of talking but a minus deviation in the age of walking and of cutting the first tooth. The 68 pairs of twins having older siblings, show a mean age of talking approximately one month (.96 mos.) later than the mean age of talking for the older siblings. These data are based on the mother's report of the ages at which the children first talked, and are therefore subjective. Although the difference lies in the same direction as the language retardation of the twins found throughout this study the subjectivity of the data and the small number of cases did not warrant further analysis.

Both the twins and their siblings were late in beginning to talk. In consideration, however, of the subjectivity of the data, the fact that the twins began to talk at a later age than their siblings seems to be more significant, in denoting their retardation, than is the comparison with the norm.

The twins appear average in respect to age of walking according to Gesell's norm. The twins also cut their first teeth within the average time stated, which is 6 to 9 months.

TABLE 14

Mean age of beginning to talk, walk, and cut teeth

	TALKING		WALKING		CUTTING TEETH	
	Mean age	Deviation —mean	Mean age	Deviation —mean	Mean age	Deviation —mean
	months		*months*		*months*	
Identical	15.3	−1.7	14.6	−.3	8.4	+.3
Like sex fraternal	17.2	+.2	15.1	+.2	9.4	+1.3
Unlike sex	18.2	+1.2	14.8	.1	7.8	−.3
All twins	17.0		14.9		8.1	

Emotional resemblance. Sixty per cent of all the twins were reported as being different emotionally. However, only 32 per cent of the identical twins were thought to differ in this respect as compared with 72 per cent of the like sex fraternals and 65 per cent of the unlike-sex twins.

Leadership. In 75 per cent of the cases, one twin was reported as showing the qualities of a leader more than the other twin. This was reported as being the case in 37 per cent of the identical twins, 87 per cent of both the

like-sex and unlike-sex fraternal twins. In the unlike-sex twins the girl was reported as being the leader approximately twice as often as the boy.

Handedness. The handedness of the twins is based upon the mother's report and not upon a test of handedness. Thirty-four or 21.0 per cent of all the twins showed some tendency to left-handedness. Table 15 shows the proportion of each type of twin, who were right-handed, left-handed or ambidextrous.

Of the 34 twins having a tendency to use the left hand, 21 or 62 per cent were boys and 13 or 38 per cent were girls. Twenty-four per cent of the identical twins showed a tendency to use the left hand although only 11 per cent were positively left-handed. Fourteen per cent of the like-sex fraternal group showed such a tendency although only 9 per cent were positively left handed. Thirty per cent of the unlike sex twins inclined in this direction with seventeen per cent definitely left handed. There were only three pairs in which both twins tended to be left handed. One of these was a pair of fraternal girls, one an unlike-sex pair, and one a pair of identical boys.

Newman's theory of the "asymmetry mechanism" and its effect on the degree of likeness found between identical twins assumes that handedness is genetically determined. If this is true, one would expect to find the percentage of left handedness in twins of dizygotic origin equal to that in the population as a whole or about 4 to 5 per cent. Of the 122 fraternal twins in this group, 15 or 12 per cent were positively left handed and twenty-five or 20 per cent showed some tendency in that direction. Some other factor peculiar to the twin situation must be operative to increase the percentage to this extent. These data are not sufficiently reliable either in number of cases or in the method of determining handedness to draw any definite conclusions. In general, however, these findings are in agreement with those reported by others. Lauterbach found about 19 per cent of the two hundred pairs of twins were left handed. He did not distinguish any group as identical twins; however, of his 63 pairs of unlike sex twins about

TABLE 15

Handedness in twins

	PROPORTION OF ALL TWINS						PROPORTION OF TWINS WITH LEFT-HANDED TENDENCY	
	Right		Left		Both			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Like sex:								
Identical	29	76	4	11	5	13	9	26
Fraternal	65	86	7	9	4	5	11	32
Unlike sex	82	80	8	17	6	13	14	42
All twins	126	79	19	12	15	9		

seven per cent were left handed. Newman summarizes the findings of Siemons (18), Weitz (21) and Dahlberg (2) on identical twins. Of the 124 pairs of identical twins in these investigations, 16.5 per cent were left handed. Dahlberg also studied 128 pairs of dizygotic twins and found 7 per cent to be left handed. Verschuer (20) found 16 per cent of 158 identical twins left handed and 13 per cent of 76 fraternal twins. Newman found 50 per cent of his 100 identical twins showing some left handedness and 15 per cent of the 100 fraternal pairs. Only 6 per cent of the fraternal group were very positively left handed. Gesell agrees with Newman that handedness is genetically determined. The fact that left handedness is sometimes a familial trait and is so frequent in twins he finds as a basis for this theory. It seems to the writer that the theory of intrauterine position as a factor causing left handedness, is supported by the frequency of left handedness in twins, especially by the fact that dizygotic twins show a higher percentage than the population as a whole.

Resemblance of the twins in general intelligence. Tables 16 and 17 show the correlations obtained for each age group and each type of twin, in the various measures of language development and in I.Q. The Pearson produce moment correlation was used throughout. In correlations between like-sex twins a shortened method of the double entry Pearsonian correlation as developed by Goodenough[6] was used.

[6] Goodenough, F. L., & Anderson, J. E. Experimental Child Study p. 239–243. Century Co., 1931.

The resemblance of the twins in general intelligence (r = +.72) is three to six points lower than that found by other investigators with one exception. The Wingfield data as reworked by the writer give an r = +.55 for all twins which is only a little higher than the resemblance given for siblings of +.50.

There are no consistent changes with age in this relationship. The correlation coefficient of +.85 of the two year olds is higher than the others, probably because nine of the twenty pairs of twins at this age are identical twins. The low correlation of the four year olds (+.37) appears to be due to the small distribution of the I.Q.'s (σ = 9.31). In agreement with the findings of Thorndike, Merriman, Lauterbach and Wingfield the coefficients of correlation for the older twins are not consistently greater than those for the younger twins.

The identical twins show a very close resemblance in general intelligence as shown by the correlation coefficient of +.92. Wingfield found a correlation coefficient of +.90 for this relationship and the writer of +.84 on Wingfield's data. The like-sex fraternal and unlike-sex groups show coefficients of +.61 and +.73 respectively. In the Wingfield data as reworked, these coefficients are +.21 and +.29. In both instances these appear to be reversed, since like-sex twins as a rule show closer resemblance than twins of unlike sex. This may be due in part to the smaller distribution of I.Q.'s in the case of both like sex fraternal groups. Why the Wingfield coefficients fall so far below that expected for twins is hard to determine. The sampling

TABLE 16

Correlations between twins at each age in language development and in I.Q.

	2 YEARS*			3 YEARS			4 YEARS			5 YEARS			ALL TWINS—AVERAGE r
	r	P.E.	σ	r	P.E.	σ	r	P.E.	σ	r	P.E.	σ	
Mean length response	+.59	±.10	0.45	+.26	±.14	0.6	+.23	±.15	0.9	+.50	±.11	1.2	+.39
Complete sentences	+.48	±.12	20.1	+.58	±.10	11.3	−.13	±.15	8.7	−.18	±.15	7.9	+.19
Incomplete sentences	+.51	±.12	15.6	+.53	±.11	11.3	−.22	±.14	8.5	−.15	±.15	8.0	+.14
Functionally complete but structurally incomplete	+.60	±.10	26.0	+.44	±.12	19.2	+.24	±.14	17.6	+.39	±.13	22.1	+.42
Simple sentences	+.21	±.14	11.3	+.34	±.13	15.6	+.00	±.15	11.3	+.38	±.13	12.9	+.23
Adapted information	+.49	±.11	22.3	+.06	±.15	16.0	+.09	±.15	14.6	+.22	±.14	20.5	+.21
Naming	+.57	±.10	16.0	+.44	±.12	12.9	−.33	±.13	11.6	+.55	±.10	18.2	+.31
Remarks about situation	+.36	±.13	11.0	+.72	±.07	13.6	−.11	±.15	11.7	+.21	±.14	14.1	+.29
Emotionally toned response	+.53	±.11	21.7	+.11	±.15	12.4	+.42	±.12	10.7	+.69	±.08	15.4	+.44
Questions	+.00	±.15	2.9	+.03	±.14	7.8	−.06	±.15	8.4	+.58	±.10	7.8	+.14
Answers	−.11	±.15	14.4	+.40	±.13	11.7	+.23	±.14	15.7	+.55	±.10	21.9	+.27
I.Q.	+.85	±.05	14.0	+.70	±.08	11.2	+.37	±.14	9.3	+.77	±.07	14.3	+.72† ±.042

* There were 20 pairs at each age except for I.Q. correlations. Here there were 12 pairs at 2 years, 16 pairs at 3 years, 17 pairs at 4 years, and 15 pairs at 5 years.

† This *r* is not an average but was plotted for 60 pairs twins, σ 12.52.

TABLE 17

Correlation between twins in language development and in I.Q.

	IDENTICAL (19 PAIRS)				LIKE SEX FRATERNAL (38 PAIRS)				UNLIKE SEX (23 PAIRS)				
	Raw	Age constant	P.E.	σ	Raw	Age constant	P.E.	σ	Raw	Age constant	P.E.	Boy	Girl
	r	r			r	r			r	r		σ	σ
Mean length response	+.89	+.80	±.04	1.21	+.42	+.28	±.10	1.1	+.63	+.40	±.12	0.8	1.1
Complete sentences	+.60	+.60	±.07	14.6	+.34	+.29	±.10	13.5	+.33	+.20	±.13	15.0	11.0
Incomplete sentences	+.53	+.53	±.08	14.4	+.36	+.31	±.10	9.4	+.31	+.22	±.14	14.5	11.2
Functionally complete but structurally incomplete	+.78	+.72	±.05	24.0	+.34	+.31	±.10	22.5	+.52	+.54	±.10	17.6	24.6
Simple sentences	+.64	+.51	±.08	15.4	+.52	+.44	±.09	14.4	+.22	+.18	±.14	12.7	18.8
Per cent total nouns	+.81		±.05	19.0	+.60		±.07	13.7	+.70		±.07	12.5	17.0
Per cent total verbs	+.67		±.08	10.3	+.19		±.10	9.11	+.48		±.10	6.7	11.4
Per cent total pronouns	+.59		±.10	8.9	+.47		±.09	8.8	+.44		±.11	7.0	7.5
Per cent total interjections	+.58		±.10	13.3	+.94		±.01	9.7	+.41		±.12	8.4	4.9
Ego-centric responses	+.56	+.52	±.08	13.4	+.02	−.04	±.10	11.9	+.58	+.53	±.10	15.5	14.4
Adapted information	+.36	+.29	±.10	21.3	+.27	+.25	±.10	18.4	+.56	+.51	±.10	16.4	20.7
Naming	+.39	+.38	±.09	13.6	+.19	+.18	±.11	13.6	+.61	+.61	±.09	16.7	18.9
Remarks about situation	+.52	+.44	±.09	16.1	+.29	+.23	±.10	23.9	+.63	+.61	±.09	11.2	13.8
Emotionally toned response	+.60	+.54	±.08	19.4	+.63	+.60	±.07	17.4	+.22	+.16	±.14	11.8	10.4
Questions	+.47	+.43	±.10	4.6	+.10	+.01	±.11	7.2	+.40	+.33	±.13	9.6	8.4
Answers	+.09	+.07	±.11	17.3	+.48	+.45	±.09	17.5	+.25	+.24	±.13	10.7	16.3
Mean coefficients		+.53				+.31				+.41			
I.Q.*	+.92		±.03	12.9	+.61		±.08	10.1	±.73		±.08	12.8	14.8

* For these correlations with I.Q. there were only 13 pairs of identical twins, 30 pairs of fraternal twins and 17 pairs of unlike-sex twins.

is relatively small, however, in all of these groups both in the Wingfield investigation and the present investigation.

The mean difference in I.Q. between the various twin groups is shown in Table 18.

As would be expected, the pairs of identical twins show consistently less difference in I.Q. than the pairs of fraternal twins. This corresponds to their closer resemblance in physical traits. Moreover, the pairs of like sex fraternal twins show less mean difference in I.Q. than the unlike sex twins in spite of the fact that the correlation between the I.Q.'s of unlike sex twins is greater than that between like-sex fraternals. This emphasizes the fact that correlations based upon different dispersions of measures are not comparable. It will be remembered that this like-sex group had a smaller standard deviation than the unlike sex group.

TABLE 18

Mean difference in I.Q. of twins

	DAY		WINGFIELD (178)		NEWMAN (114)	
	Number of pairs	Mean difference, I.Q.	Number of pairs	Mean difference, I.Q.	Number of pairs	Mean difference, I.Q.
Identical	13	3.46	45	6.23	50	5.3
Like sex fraternal	30	6.83	76	8.5		
Unlike sex	17	10.18	26	12.0		

Resemblance of the twins in measurements of language development. When considered from the standpoint of age groups, the correlation coefficients present negative, zero and positive relationships. In general the two year old group show the higher correlations and, as in the case of the I.Q.'s, this may be due largely to the large number of identical twins at two years. In Questions and Answers, both of which were found to increase considerably with age. Coefficients of the five year old of +.58 and +.55 show much greater relationship between the twins than those at any other age. Over the age period at which rapid change is taking place in any function, higher relations are found between the members of the pairs. In the use of complete and incomplete sentences the two and three year olds show coefficients around +.50 whereas a slight negative relationship appears at four and five years. There is not sufficient consistency in the changes of these correlation coefficients from age to age to show either that the twins grow more or less alike with age or even that their resemblance remains about the same.

The resemblance between twins of each type in measures of language development are also quite variable. In mean length of response and the phases of the construction of sentence analysis and word analysis with the exception of the percentage of interjections, identical twins show a consistently higher correlation than do the fraternal groups. In the functional

analysis, however, this is not true. In fact, with two exceptions (emotionally toned responses and answers) the unlike-sex group show closer resemblance. The phases of the functional analysis, because they are functional in nature might be expected to show less relationship between members of a pair than those, such as the phases of the construction analysis, which are of a developmental character.

The unlike-sex group show a correlation coefficient higher than the like-sex fraternal group in the functionally complete but structurally incomplete responses, the percentage of total nouns and percentage of total verbs. They show closer resemblance than either the like-sex fraternals or the identical group in ego centric responses, adapted information, naming, and questions. In all of these phases, however, the unlike-sex group show a larger distribution of measures, than the other groups, which in part will account for this.

The average resemblance in these measures of language development for identical twins is +.53, for like-sex fraternal twins, +.31 and for the unlike sex twins +.41.

Relation of certain environmental factors to the language development of the twins. An effort was made to find out how frequently stories were read or told to the twins in order to see if this affected in any way their language development. The estimate the mother made as to the frequency of reading stories was, of course, very rough. These estimates grouped themselves into four categories as follows:—the children were read to daily, several times a week, occasionally or not at all. Eighty-five per cent of the two year olds were not read to at all, as compared with 45 per cent of the three year olds, 15 per cent of the four year olds and 10 per cent of the five year olds. Since it seemed probable that the frequency of reading stories was related primarily to occupational status, occupational class was held constant in a correlation between frequency of reading stories and the mean length of response. A correlation coefficient of +.56 between frequency of reading stories and mean length of response was reduced to +.02 ±.533 when occupational class was partialed out. It becomes very evident with this zero correlation that frequency of reading stories had no relationship to mean length of response but was related to the occupational status of the family.

The effect of the imitation of the language of the twins, by other members of the family, on language development was determined by means of a bi-serial correlation between imitation of speech and mean length of response. In this instance, the imitation of speech could be grouped readily only into two categories: the cases that were imitated and those that were not imitated. The bi-serial r coefficient is −.35 showing a negative relationship between these two variables. This is in agreement with the popular belief that the imitation of the child's language is undesirable from the standpoint of the best language development. Moreover, in the twin situation, it only adds to the disadvantage resulting from the twins imitating each other. In approximately 33 per cent of the cases it was

reported that members of the family imitated the speech of twins.

Twinning in the ancestry

The information obtained in regard to twinning in the ancestry was not sufficiently specific to show exact relationships. Of the 68 pairs of twins from whom this information was obtained, 68 per cent had relatives who were twins; 26 per cent on the mother's side, a similar percentage on the father's side, and 16 per cent had twin relatives on both sides of the family. There was no striking difference in this respect between identical and fraternal twins with the exception that more of the former had twin relatives on both sides of the family (33 per cent). These data are based on so few cases, however, that such a difference is probably due to selection. Moreover, since comparable data for the general population are not available the significance of these percentages is highly uncertain.

SUMMARY

The results of these data may be summarized as follows:

1. Twins are below average in intelligence test performance. The 568 pairs of twins represented by the Merriman, Lauterbach, Freeman, Wingfield and present study had a mean I.Q. of 96.3.

2. Fraternal twins were found to be from 2 to 7 points below identical twins in general intelligence in the Merriman, Freeman, Wingfield and present investigations.

3. The language retardation of the twins did not reduce the total test score of the intelligence test. When the mean score on the verbal test items of the intelligence tests of the twins was compared with that of the control group they were found to be equal.

4. The language retardation of the twins in terms of "language quotient" is very much greater than is their retardation in general intelligence in terms of I.Q.

5. Identical twins were found to resemble one another much more closely than fraternal twins. A correlation coefficient of +.92 was found for identical twins in general intelligence as compared with +.61 and +.73 for the like-sex and unlike-sex fraternal twins. The mean coefficient of correlation for the identical twins in the various phases of language development was +.53 as compared with +.31 and +.41 for the like-sex and unlike-sex fraternal twins.

6. In agreement with the other studies the older twins showed about the same resemblance in the traits measured as the younger twins.

7. The twins of the present study, on the average, began to talk 1 month later than their older siblings.

8. They were not found to be retarded in age of beginning to walk or in the appearance of the first tooth, when compared with norms for the general population.

9. Twenty-one per cent of the group showed a tendency to be left-handed. This is similar to the findings of other studies of twins.

10. Sixty per cent of the twins differed emotionally although only 32 per cent of the identical twins were thought to differ in this respect.

11. In 75 per cent of the twin pairs,

1 was thought to be the leader. In unlike-sex pairs the girl was thought to be the leader twice as often as the boy.

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The Development of Logical Selection in Word Meaning Among School Children[1]

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THE Indiana Mental Survey Test, Schedule D, contains as one of its sections a list of ten words, each followed by a group of words more or less closely related. Of these words two are always associated with the key word, while the others are not. An analysis of this particular item might afford interesting data on the growth of logical selection in children. A large number of marked papers were available from a study made some years ago by Pressey (1), so the raw data for such an analysis were at hand.

The pertinent section of this test is Number 2, Logical Selection, the contents of which are here reproduced with the two correct responses indicated in italics.

INDIANA MENTAL SURVEY TEST, SCHEDULE D

II. Logical selection

Examples

Book: table, *pages,* shelf, *printing.*

Chair: arm, cushion, *legs,* rocker, *seat.*

1. Cat—*fur,* house, milk, *claws*
2. Tree—apples, *branches,* acorns, *roots,* flowers
3. Spelling—book, writing, pencil, *words,* margin, *letters*
4. School—blackboard, *teacher,* window, pen, bell, school-house, *pupils*
5. Store—counter, *clerk,* cash-register, advertisements, *goods,* boxes, stove
6. Building—windows, wood, chimney, *wall,* shingle, *roof,* stairs, shed
7. Debt—mortgage, *creditor,* money, lawyer, collector, *debtor,* bankruptcy
8. Sickness—lameness, death, *weakness,* hospital, nurse, *discomfort,* doctor
9. Government—*capitol,* consul, navy, freedom, king, senate, cannon, *tax*
10. Friendship—adoration, *liking,* lover, obedience, imitation, *helpfulness,* worship

The instructions given to the pupils by the examiner are: "Just below where you have been writing are some words in big letters. Each is followed by a list of other words in small letters. Look at the samples: the first word in big letters is book. What two things in the list following is a book never without? Those 2 words are under-

[1] Publications of the Indiana University Psychological Clinics, Series II, no. 3. The complete tables referred to in this paper are on file at the Psychological Clinic at Bloomington.

lined. Look at the second example. What 2 things in the list following 'chair' is a chair never without? Put a line under each of these two words. Now, attention! In each of the 10 lists, just below, put lines under the 2 words which the word in large letters, at the head of the list, is never without. And just one thing more: do not underline more than two words in any list."

The 2,050 cases used were selected from some 3,500 papers marked by children in the schools of Bloomington, Bedford, Logansport and Jeffersonville, Indiana, and a few other scattered schools of the state. The papers were sorted by age and all the papers were eliminated on which directions had not been followed. From the remainder, the first 100 papers of boys and the first 100 papers of girls at each age were selected with three exceptions. Only 50 papers for each sex at ages eight and eighteen and only 25 papers for each sex at age nineteen were found available. When the cases at each age were arranged according to the score on the complete test, it was found that they closely approached a normal distribution. We feel, therefore, that our subjects were not selected on the basis of ability.

TABLE 1

Significance of sex differences

$\frac{\text{DIFF.}}{\sigma \text{ DIFF.}}$	PER CENT	NUMBER OF CASES
No difference	14.6	116
0–0.9	39.3	311
1.0–1.9	37.1	295
2.0–2.9	7.3	58
3.0–4.0	1.5	12

Results. If it were possible to consider the sexes together, the analysis of several typical developmental curves would be greatly simplified, therefore it seems wise to consider the sex comparisons at once. As there were 66 words from which the selections were made and there were 12 age groups for each, there is a total of 792 comparisons. For each of these the differences and σ differences of the percentages have been calculated. Table 1 shows the distribution of the $\frac{\text{diff}}{\sigma \text{ diff}}$ values.

As is evident, only 1.5 per cent of the comparisons are significant according to the usual criterion that the difference should be at least three times its standard deviation. The 12 cases which are significant are shown in detail in table 2. Seven of these are scattered among 5 of the key words and apparently exhibit no consistent trend. The remaining 5 are all found in relation to the key word FRIENDSHIP. *Liking* is felt to be necessary to friendship by 21 per cent more fourteen-year-old girls than boys, and the significance of this difference is expressed by a ratio of 3.1. One might think of this as a sex difference influenced perhaps by adolescence but at year thirteen the ratio is only 0.3 and at fifteen there is no difference at all. Of nineteen-year-old girls 32 per cent selected *adoration* while no boys selected it. Here again the immediately preceding age shows a very small significance expressed by the ratio of 0.7. *Helpfulness* was selected by 27 per cent more girls than boys and in this case the ratios of the neighboring ages suggest that this may be characteristic. Fifteen-year-olds show

a ratio of 1.2; sixteen-year-olds, of 4.0; seventeen-year-olds, of 2.3; and eighteen-year-olds, of 1.8. At nineteen the ratio is 1.3, but the difference is in favor of the boys, of whom 10 per cent more selected the word. Of all the selections for this key word, that of *lover* is most interesting. At age thirteen there is no difference; for the succeeding ages the differences always show the boys with the greatest percentage selection until age nineteen, when again there is no difference. The significance of the differences are expressed by the ratios: year fourteen, 2.5; fifteen, only 0.2, the difference being only one per cent; sixteen, 3.1; seventeen, 3.0; and eighteen 1.4. It would appear that by late adolescence friendship has more of a sexual significance for boys than for girls. However, the percentage of boys selecting the word at these ages ranges closely about 25, so that a suggestion such as the above cannot be made into a very wide generalization.

In regard to sex differences in this type of logical selection, it appears that one can safely conclude there are none of significance. Accepting this conclusion as true, we have proceeded with our further analysis on the basis of percentage selection of the total group.

Developmental curves. The data presented in the following discussion are based on the choices made by 200 boys and girls at each age except at ages eight and eighteen, where there were only 100, and at age nineteen where there were only 50 cases. The percentages of children at each age selecting each of the words have been calculated and for each of the 10 key words charts have been drawn to illustrate the changes in selection made with advancing age. The limitations, imposed by journal publication, make it impossible that all of the tables and charts be reproduced. For the purposes of our discussion we have selected 4 key words which illustrate types for

TABLE 2

Words showing significant sex differences

KEY WORD	WORD	AGE	DIFF. / σ DIFF.	PER CENT		DIFFERENCE	
				Boys	Girls	Boys	Girls
Store	counter	8	3.0	26	54		28
Store	cash-register	15	3.6	1	14		13
Building	shingle	9	3.2	14	2	12	
Debt	bankruptcy	8	3.2	26	4	22	
Sickness	hospital	9	3.0	6	20		14
Government	senate	15	3.0	40	61		21
Government	tax	18	3.2	68	38	30	
Friendship	adoration	19	3.4	0	32		32
Friendship	liking	14	3.1	52	73		21
Friendship	lover	16	3.1	28	11	17	
Friendship	lover	17	3.0	23	8	15	
Friendship	helpfulness	16	4.0	46	73		27

detailed discussion. Reference will be made when pertinent to data from tables not here presented.

The curves for the first 3 key words—CAT, TREE, SPELLING—show that the correct and incorrect responses are not confused even at the lowest ages. The data of table 3 show the percentage choices for the word CAT.

Claws and *fur*, both of which are essential to the concept cat, were marked by about 90 per cent of eight-year-olds and the percentages increased with age. Conversely the non-essential elements, *milk* and *house*, were marked by 10 per cent or less. A similar divergence is to be found in the response to TREE. The correct responses to SPELLING were marked by about 55 per cent of the eight-year-olds and the percentages increased until they reached about 85 at age fifteen. Thereafter there is little increase. Interesting, however, is the response to *writing* which was selected by 40 per cent of the eight-year-olds; the percentages decreased slowly to a minimum at eighteen years of 12 per cent. This is the first instance in the series where a word is included which has a direct bearing on the subject's activity in relation to the key word. For the school child writing is closely connected with the spelling lesson and this is reflected in the relatively high percentage who selected this word as being always associated with spelling.

TABLE 3

Responses to "cat"

AGE	FUR	HOUSE	MILK	CLAWS
8	86.0	10.0	12.0	92.0
9	93.5	5.0	7.0	94.5
10	94.5	3.5	4.5	97.5
11	99.0	1.0	2.0	98.0
12	97.5	2.0	2.5	98.0
13	100.0	0.0	0.5	99.5
14	99.5	0.0	0.5	100.0
15	99.0	0.0	1.5	99.5
16	99.5	0.5	2.5	97.5
17	100.0	0.5	0.0	99.5
18	99.0	0.0	1.0	100.0
19	100.0	0.0	0.0	100.0

The second typical group of curves may be illustrated by the response to SCHOOL, as shown in table 1. Here about two-thirds of the younger children selected *teacher*, and with some depression in the percentage at ages twelve to fourteen, it increased to 82 per cent at age nineteen. The younger children feel, however, that the other essential element of school is the *blackboard*, as also represented by a response of two-thirds of the eight-year-olds. The percentage selecting this word steadily and rather swiftly declines to a minimum of 4 per cent at nineteen years. The other correct response, *pupils*, is selected by only 24 per cent of eight-year-olds but the percentage steadily increases to a maximum of 74 at nineteen years. The same sort of curves are seen in the choice for STORE. *Clerk* is consistently high, *goods* starts low but steadily increases, and *counter* starts high and decreases. Here again, as in response to SPELLING, the words *blackboard* and *counter*, which are important elements in the child's behavior in the school and store situations, are selected as being essential to the concept by the younger children.

A third group of cases are those for BUILDING, DEBT, and SICKNESS, illus-

trated in table 5 by the responses to BUILDING.

These are characterized by the very small percentage selection of the correct words at the younger ages and the subsequent increase and also by the selection of incorrect words by the younger children with a subsequent decrease. For BUILDING, *window* and *chimney* are selected by over 50 per cent of the eight-year-olds; and for DEBT, *lawyer* and *money* are selected by 41 and 63 per cent, respectively, of eight-year-olds. Only *doctor* was selected by 60 per cent of the eight-year-olds in relation to SICKNESS. *Wall* and *roof* were selected by 20 to 30 per cent of eight-year-olds, and then the percentage selecting them rose steadily and rapidly to 70 and 86 per

TABLE 4

Responses to "school"

AGE	BLACKBOARD	TEACHER	WINDOW	PEN	BELL	SCHOOL-HOUSE	PUPILS
8	63.0	68.0	11.0	7.0	12.0	15.0	24.0
9	51.0	76.5	16.5	4.5	5.5	10.0	36.0
10	44.0	64.5	25.5	0.5	6.5	20.0	39.0
11	34.5	68.0	27.0	2.0	1.5	30.5	36.5
12	26.5	60.0	29.5	0.5	2.5	36.0	45.0
13	22.0	57.0	35.0	1.0	2.0	32.5	50.5
14	21.0	59.0	28.0	0.0	0.5	38.5	53.0
15	16.5	64.5	22.5	0.0	2.0	36.0	58.5
16	20.5	61.5	26.0	0.0	1.5	35.5	55.0
17	10.5	74.5	16.5	0.0	1.5	29.5	67.5
18	11.0	76.0	15.0	1.0	1.0	23.0	73.0
19	4.0	82.0	12.0	0.0	0.0	28.0	74.0

TABLE 5

Responses to "building"

AGE	WINDOW	WOOD	CHIMNEY	WALL	SHINGLE	ROOF	STAIRS	SHED
8	60.0	20.0	52.0	20.0	8.0	28.0	6.0	6.0
9	60.0	19.5	52.0	21.5	8.0	30.5	5.5	3.0
10	51.0	20.0	45.5	30.5	6.5	42.5	3.0	1.0
11	53.5	11.5	38.0	41.5	4.5	48.5	2.0	0.5
12	40.5	16.0	23.0	54.0	6.0	59.0	0.5	1.0
13	43.5	24.0	15.5	53.5	3.0	59.5	0.0	1.0
14	39.5	17.0	17.5	56.0	4.5	64.5	0.5	0.5
15	31.5	16.0	18.5	59.0	3.0	72.0	0.0	0.0
16	32.5	17.0	10.0	63.0	2.5	73.5	1.0	0.5
17	26.5	16.0	7.5	72.5	3.0	74.5	0.0	0.0
18	20.0	18.0	5.0	72.0	4.0	81.0	0.0	0.0
19	20.0	20.0	4.0	70.0	0.0	86.0	0.0	0.0

cent respectively at nineteen. The essential elements of a DEBT, *debtor* and *creditor*, were selected by less than 20 per cent of eight-year-olds, but the percentage increased to 80 and 66 per cent respectively at age nineteen. This particular type of development is not shown so clearly with SICKNESS, where *doctor* is the only non-essential response selected by a large percentage of eight-year-olds. Of the correct responses, *weakness* was chosen by 48 per cent and *discomfort* by only 12 per cent of eight-year-olds. At nineteen years both of these were picked by about 80 per cent.

The last group of curves are those for GOVERNMENT and FRIENDSHIP, in both of which there is great overlapping, although it is more evident for the former. The responses to GOVERNMENT are shown in table 6. For eight-year-olds, *tax*, *king*, *navy*, *freedom*, and *capitol* were all selected by over 30 per cent of the children. *King*, *navy*, and *freedom* start a somewhat rapid and steady decline, while for twelve-year-olds *senate*, which started at 6 per cent, has increased to 36 per cent and reaches a maximum of 50 per cent for fifteen-year-olds. The correct responses, *capitol* and *tax*, steadily but slowly increase from the percentages of 42 and 30 at eight years to 74 and 62 at nineteen, but their development is at greatly different rates and they are always widely separated. This confusion is not so evident in FRIENDSHIP which more nearly resembles the responses to SICKNESS. Here the correct responses, *helpfulness* and *liking*, rise from percentages of 39 and 50 at eight years to 72 at nineteen, while *lover* starts at 45 per cent and decreases to less than 20.

TABLE 6

Responses to "government"

AGE	CAPITOL	CONSUL	NAVY	FREEDOM	KING	SENATE	CANNON	TAX
8	42.0	7.0	33.0	39.0	31.0	6.0	12.0	30.0
9	59.0	10.0	30.0	35.5	17.5	11.5	6.0	30.5
10	55.5	11.5	19.0	38.5	18.5	13.0	3.5	40.5
11	57.0	21.5	12.5	34.5	10.0	27.0	3.0	34.5
12	57.0	23.0	10.5	25.5	13.0	36.0	3.5	31.5
13	65.0	24.5	11.0	15.5	8.5	37.5	0.0	38.0
14	72.0	17.0	8.5	18.5	3.5	40.5	0.5	39.5
15	74.5	15.5	6.0	11.0	4.5	50.5	0.5	37.5
16	73.5	15.5	8.0	15.5	5.5	41.5	1.5	39.0
17	75.5	13.0	10.5	13.0	8.0	27.5	0.5	52.0
18	78.0	9.0	8.0	15.0	6.0	31.0	0.0	53.0
19	74.0	16.0	2.0	16.0	12.0	16.0	2.0	62.0

Discussion. The first six key words, CAT, TREE, SPELLING, SCHOOL, STORE, and BUILDING might be labeled concrete, and of these the third is an activity rather than a thing. Consistently throughout this group it seems evident that the younger children tend to choose related words which have a subjective reference. Disre-

garding the very simple series for CAT, we find that, of the incorrect words under TREE, *apples* is picked more frequently; under SPELLING, *writing;* under SCHOOL, *blackboard;* under STORE, *counter;* and under BUILDING, *window* and *chimney*. In each of these cases the correct word is one which has a direct relation to the child's activity in responding to that situation. He eats and enjoys apples from trees, at the same time he realizes that not all trees have apples; he writes his spelling lesson; in school his activity is directed toward the blackboard; at the store the counter is a focus of interest; and the child's building, usually on paper, emphasizes the presence of chimney and windows, or on the buildings he sees these are Gestalten set against a background of roof and wall.

Thus the younger children tend to feel that those things having a relation to them are essential to the concept. With increased age this basis of selection disappears. In all of these cases the differentiations between essential and non-essential relations have been made by twelve years of age. This self-reference is in striking harmony with the findings on play interests. Here the younger children are individualistic but with advancing age the reference tends to extend to other individuals—the self is extended to include companions.

The remaining key words, DEBT, SICKNESS, GOVERNMENT, and FRIENDSHIP, might be called abstract. In the responses to these we find a much greater variation. The younger children pick one or more unessential words and these words usually have a self-reference, e.g., *doctor* for SICKNESS. There is also evident in the younger children's responses the tendency to mark a word which may be more familiar, e.g., *money* as necessary to a DEBT, *navy* and *king* for GOVERNMENT. The final separation of essential and non-essential words occurs at varying but usually higher ages. Thus for DEBT it occurred at fourteen years, for GOVERNMENT not until sixteen, but for SICKNESS and FRIENDSHIP it took place at twelve years. There is also evidence that the development of vocabulary tends to assist in the final separation of the two types of responses. Thus *creditor* and *debtor* are selected by less than 20 per cent of eight-year-olds, and a 50 per cent selection is not reached until after fourteen years. In responding to GOVERNMENT, the curves for *senate* and *tax* interlace around 40 per cent from twelve to sixteen years.

It would appear that the development of logical relation of concepts passes through a stage of self-reference in children from eight to ten or eleven years of age. Furthermore the development of vocabulary is an important factor in the process of concept formation. Another point of interest is that, except for CAT and TREE, the essential elements were never selected by 100 per cent of the subjects even at the highest ages.

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Emotional Development in Early Infancy

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THE emotional behavior of 62 infants in the Montreal Foundling and Baby Hospital was carefully observed and recorded daily over a period of three or four months. The circumstances attendant upon these reactions were noted, and the whole data was studied from the point of view of development from age to age. A summary of the findings will be presented in the following paragraphs. They will be seen to lend support to the writer's (2) (3) theory of the genesis of the emotions and to add further illuminating detail.

The babies under observation were in separate wards more or less according to age. In different rooms were infants under one month, one to three months, three to six months, six to nine months, nine to twelve months, and twelve to fifteen months. An older group of children between fifteen and twenty-four months of age played together in the nursery.

Table 1 shows the number of children at the different ages whose behavior was observed for this study.

Development in the emotional behavior of the young child comprises 3 main classes of change. From birth onward there is a gradual evolution of the emotions taking place. The earliest emotional reactions are very general and poorly organized responses to one or two general types of situation. As weeks and months go by the responses take on more definite form in relation to more specific situations. It seems to the writer, as already mentioned elsewhere, that in the course of genesis of the emotions there occurs a process of differentiation. Coincident with the partial isolation of certain responses is a combining of the simpler reactions within the unit responses and the formation of bonds of association between these emotional syndromes and detailed aspects of the provoking situations. In this manner slowly appear the well known emotions of anger, disgust, joy, love, and so forth. They are not present at birth in their mature form.

TABLE 1

AGE	NUMBER OF CHILDREN
months	
Under 1	3
1–3	16
3–6	23
6–9	18
9–12	11
12–15	20
15–18	8
18–21	5
21–24	6
Over 24	2

In addition to the progressive evolution of the emotions, there is, going on at the same time, a gradual change in the mode of response of each specific

emotion. Muscles are developing, new skills are being learned. So that the anger, for instance, expressed by the eighteen-month-old differs in detail of form from the anger manifested by the ten-month-old baby. Fresh bonds of association are being made between emotional behavior and the always slightly varying attendant circumstances. Different situations come to have emotional significance for the growing child and subsequently provoke emotional responses. Thus a gradual substitution takes place of the situations which prompt the emotions. In the language of the behaviorists, emotional responses become conditioned to fresh stimuli.

EXCITEMENT, THE ORIGINAL EMOTION

After observing the behavior of babies *under one month* of age, the writer felt more than ever convinced that the infant does not start life with 3 fully matured pattern reactions, such as have been mentioned by behaviorists and named fear, rage and love. Unfortunately the writer was not able to observe the infants within a few hours of birth, but this fact in no way invalidates observations made on children two or three weeks old. Moreover, if the above named emotional responses are really the 3 great primary emotions from which all our adult emotions are derived, surely they may still be observed a month or more after birth. And, even if the process of conditioning begins before or immediately upon birth, one may expect the original emotion-producing stimuli to elicit their natural responses at least for two or three weeks after birth.

It was observed in the hospital that, on presentation of certain strong stimuli the infants became agitated, their arm and hand muscles tensed, their breath quickened, and their legs made jerky kicking movements. Their eyes opened, the upper lid arched, and they gazed into the distance. The stimuli producing such agitation or excitement were: bright sun directly in the infant's eyes, sudden picking up and putting down on the bed, pulling the child's arm through his dress sleeve, holding the arms tight to the sides, rapping the baby's knuckles, pressing the bottle nipple into the child's mouth, and the noisy clatter of a small tin basin thrown on to a metal table whence it fell to the radiator and the floor.

The loud sound startled only four of the one- and two-month-old babies, while six others lay practically undisturbed. None of the infants cried after hearing the noise. The same experiment was tried upon children of successive ages up to fifteen months. Under two or three months the reaction was one of sudden but rather mild general excitement as described above. Children of three or four months and older gave more of a jump and looked definitely in the direction of the sound. Afterwards they remained still with eyes and mouth open, and stared towards the source of the commotion. One baby of eight months stiffened and turned away on the second trial. The corners of his mouth turned down, his eyes moistened and he looked to the adult for sympathy and comfort. Another child of eleven months sat wide-eyed and still, the corners of his mouth drooping as if he were ready to

burst into tears. The older child then merely stood, or sat, alert and attentive without further sign of distress.

Lowering the babies suddenly into their cribs, and in some cases lifting them quickly, also startled and excited them. Sometimes they would cry following upon such a surprise. Rocking a quiet child would cause him to open his eyes attentively. But gently rocking a crying infant would often, though not always, cause him to reduce his activity, stop crying, and eventually become tranquil. Gentle handling, slow patting, wrapping in warm blankets, and nursing easily soothed an agitated or crying infant, making him relax and yawn and become sleepy.

Light pinching of the arm left the three- or four-week-old baby unmoved. Deeper pressure caused him to kick slightly, breathe faster and move his arms. A sharp flick on the hand produced similar agitation, but a second rap resulted in a sudden check to breathing followed by a prolonged cry and other signs of distress. The first exciting experience had been found disagreeable and the second rap produced unmistakable distress.

Time after time on waking suddenly from sleep the infants were observed to wave their arms jerkily, kick, open and close their eyes, flush slightly, and breathe quickly and irregularly. Some grunted, some cried spasmodically for a moment or two, while others cried loudly for several minutes. The combined stimulation of light, of sounds, of damp or restricting bed clothes, and the change from sleeping to waking breathing-rate seemed to produce a temporary agitation and often distress. Waking apparently requires emotional adjustment.

The hungry child before feeding would often show restless activity, waving, squirming, mouthing and crying at intervals. The infant who had been lying in one position for a long time and the tired child before falling asleep would also show emotional agitation. Their breath would come jerkily, uttering staccato cries of "cu-cu-cu-ah," and they would thrust out their arms and legs in irregular movements. At the moment the nipple was put into the hungry baby's mouth he again breathed quickly, occasionally cried, waved the free arm, and kicked in excited agitation.

The emotional reactions of the tiny infant are certainly not highly differentiated. The most common response to highly stimulating situations seems to be one of general agitation or excitement. It is a question which word most aptly describes the behavior. The former perhaps conveys more the idea of general disturbance, although the two words are often used synonymously. This vague emotional response to a large variety of circumstances must surely be one of the original emotions, if not the only one.

A kind of general excitement over new and startling or other highly stimulating circumstances may be seen at any age. The behavior manifestations vary from time to time, but the main characteristics of accelerated response, alertness, slight tension or restlessness remain as constant attributes. In the babies, excitement is frequently manifested in kicking movements. The month-old infants kick jerkily with both feet at random. In

another month or so, the kicking becomes more regular, the legs being thrust out alternately. By five or six months the babies express their emotions in combined leg thrusts, kicking with one foot, and in swinging the legs from the hips. At fourteen months when the children can stand they will hold on to a support and "mark time" with their feet or stamp. Stamping, jumping and running express excited agitation at a still later age.

Two- and three-month-old babies may be seen to suck their thumbs or fingers rapidly in moments of stress. At seven months and over, children bite, pull and suck their garments, as well as their fingers. This behavior seems to produce a gradual subsidence of the emotion. Body-rocking accompanied in many instances by rhythmic vocalizations is another expression of mixed emotion. Hungry, annoyed, excited or restless children will sit and rock for minutes on end. The five-month-old baby lies prone and pushes with his knees, or sways when lying dorsally. Seven-month-old infants support themselves on their arms and rock back and forth murmuring "m̄m-ŭm, m̄m-ŭm." After nine months they sit up and rock to and fro, or they kneel and bounce up and down holding on to the crib bars. Sometimes they sit and bump their backs against the side of the crib. This kind of behavior was observed in the nursery up to eighteen months of age.

Rhythmical movements were observed not only to be the outcome of emotional excitement or tension, but they were seen to have a soothing and pacifying effect. These must be attempts at adjustment on the part of the organism to reduce tension and restore emotional equilibrium or tranquility. In the light of these observations, it can be easily understood how long walks, games, field sports, singing, dancing, and sea-voyages are found to be so universally health-giving and positively curative for "nervous wrecks."

DISTRESS AND ITS DERIVATIVES

It is a moot question whether "distress" is an original emotion or whether it is a very early differentiated reaction to disagreeably painful and unsatisfying experiences. It may be that it is a part of the general emotional response of excitement which copes more satisfactorily with obnoxious stimuli. Tense muscles resist or remove pressure; activity warms a chilled body and reduces tension; and cries, at first reflex due to the rush of air in and out of the lungs, bring comfort and aid. These responses become differentiated from excitement, associated together and conditioned to the disagreeable stimuli as a result of experience. If such differentiation actually takes place, it must begin immediately after birth. For the two emotions of excitement and distress are already distinguishable in a three-weeks-old infant.

On the other hand, it is possible that there is a native emotional response to pain, particularly muscle pain. The sympathetic branch of the autonomic nervous system is predominantly active and the overt behavior is definitely that of distress. Other stimuli, such as loud sounds and sudden falling merely produce startled excitement. Blanton (1) observed that the infant's cry of colic had a specially shrill char-

acter accompanied by rigidity of the abdominal walls. She also noted that infants during the first days of life cried from "(1) hunger; (2) in response to noxious stimuli (including rough handling, circumcision, lancing and care of boils, sores, etc.); and (3) possibly fatigue or lack of exercise." The writer has observed the same phenomena in three-weeks-old babies. But, hunger, rough handling, and fatigue were also noticed on many occasions to produce a restless excitement rather than specific distress.

It is not easy, in the case of the very young infant, to distinguish distress from general agitation. Perhaps the most characteristic marks of the former are greater muscle tension, interference with movement and with breathing, closing of the eyes, and loud rather high-pitched crying. In children of two months and over, the eyes become moist and tears may flow. The crying of the infant *under a month* or even six weeks often seems to be part of the general activity in excitement. Breath comes more or less regularly, the cry emerging on both intake and expiration of air. There are no tears, and the skin does not flush. Movement is free though rather jerky; and the mouth is held open in an elliptic, round, or square shape.

The cry of distress, recognizable in the *month-old* baby, is irregular. There are short intakes of breath and long cries on expiration. The eyes are "screwed up" tight, the face flushed, the fists often clenched, the arms tense, and the legs still or kicking spasmodically. The mouth is open and square in shape or, more usually kidney-shaped with the corners pulled down. The pitch of the cry is high and somewhat discordant, and sounds something like "ah, cu-ah, cu-ah, cu-ăh."

Cries of distress were heard from month-old babies in the hospital on the following occasions; on waking suddenly from sleep, struggling to breathe through nostrils blocked with mucous, when the ears were discharging, when lying awake before feeding time, after staying long in the same position, lying on a wet diaper, when the child's buttocks were chafed, and when the fingers were rapped. The three main causes of distress at this age, therefore, seemed to be discomfort, pain, and hunger.

Crying from discomfort and on awakening usually developed slowly, and sounded like "cu-cu-cu-cah-ah—." The cry of pain came suddenly, often after a holding of the breath. The sound was a loud shrill prolonged "ă-ă-ă," and lowered in pitch slightly from the first emission. The cries of hunger were rather like those of discomfort. The former came perhaps more in intermittent waves; the intervening moments being taken up with mouthing or sucking movements. Occasionally the hungry child would utter a sharp loud cry, as if in pain, and then whine or moan for a time.

Two-month-old babies cry less of the total waking time; but slighter discomforting stimuli seem to cause distress more frequently than in the case of the younger infants. They are more disturbed by a wet diaper, by flatulance, and by tight clothing which restricts movement and makes breathing difficult. Their movements are freer and they tend to move their heads from side to side when they

are distressed. While one-month-old babies kick irregularly with jerky movements, the two-month-old kicks his legs alternately and more regularly. He waves his arms up and down when agitated or distressed, as well as in spontaneous play. The sound or sight of an approaching person will not quiet his distress; but being picked up will do so, or being fed if he is hungry.

By *three months* of age a child will cry and show other signs of distress when placed in an unusual position or moved to a strange place; as, for instance, when lain temporarily at the foot of another child's bed. He will wave his arms laterally as well as up and down, and will kick more vigorously. The hospital baby has learned to associate feeding time with the presence of an adult; for, when he is hungry he shows some excitement at the close approach of a person. He stares at the person's face, waves, kicks, breathes faster, and opens his mouth. If no food is forthcoming, he becomes more tense and jerky in his movements and begins to cry. He is distressed at the delay in normal proceedings.

Should the adult remain tantalizingly near for some minutes without either picking up the child or feeding him, his cry increases in intensity, his eyes become moist with tears, he holds his breath longer, and utters prolonged flat "ă-ă-ă" sound reminiscent of an older child's "paddy" or temper cry. The infant's motor responses were all set for being picked up and fed, and then he was thwarted and disappointed. His excitement changed into bitter distress with a semblance of angry vexation.

The slight change in vowel sound of the cry, the long holding of breath combined with more than usually vigorous leg thrusts and arm movements, seemed to suggest that the emotion of anger is beginning to evolve from general distress at about this age. Although for the most part the distress shown at discomfort differs almost imperceptibly from distress in response to disappointment, occasionally the latter includes, to a marked degree, those behavior elements peculiar to the emotion of anger. The situations which evoke these demonstrations of temper in the tiny infant are a stop or check in the progressive satisfaction of a physical need. In the above instance the child's appetite was aroused but not satisfied. Lack of even the first sign of a need being satisfied merely produces vague distress.

A *four-month-old* baby shows distress at the same general sort of situation that troubles the younger child. He is, however, less frequently disturbed by bodily discomfort. He moves about sufficiently to relieve tired muscles and local pressures, and to eliminate gas from his stomach. He cries vigorously at delay in the feeding process and may show decided temper on such occasions. His arms then stiffen and tremble; he screws up his eyes, flushes, holds his breath and utters prolonged and irregular cries on expiration of breath; he kicks violently, pushes with his feet and looks at any adult, presumably to see the effect. He is getting very fond of attention at this age, and will show distress and often anger when a person leaves the room or ceases to pay attention and play with him.

At *five months*, the baby's interest in small objects, such as rattles, stuffed animals and, of course, his milk bottle, causes him to be distressed when these objects are removed. He may express his displeasure as formerly by crying, squirming, waving and kicking, but he may also be heard merely to call out in a protesting tone of voice, "ah aye," without the half-closing of the eyes and the accompanying tensions of crying.

By this age the child may show slight revulsion for certain foods, coughing, spluttering, frowning and crying while he is being fed. Chopped vegetables and soup too thick in consistency were specially disliked by some babies in the hospital. Cereals, milk, and sweetish foods were almost always taken readily. It was noted that babies under three months often refused to drink sterile water. They just let it run out of their mouths without swallowing. There was no emotion involved in this reaction. Similarly, three- and four-month-old babies sometimes rejected their thin vegetable soup, but were not very disturbed about it. A genuine emotional revulsion did not appear till five months or later. Perhaps this is the beginning of the emotion of disgust. Revulsion at nauseating sights and smells, the adult form of disgust, apparently does not develop until two or more years of age.

Several of the babies in the hospital *between six and eighteen months* were observed to splutter and choke, and refuse to swallow spinach more than other vegetables. The mouthfuls that were rejected were usually, though not always, those containing large or stringy pieces of spinach. When the latter was chopped fine it was swallowed a little more easily; but only when it was mixed with other vegetables was it eaten without any protest. There must be factors other than consistency and size of morsel to account for this objection to spinach.

It seemed to the writer that some cans of spinach tasted more bitter than others and were less palatable on that account. In order to find how the children would react to a bitter taste, two teaspoonsful each of unsweetened grape-fruit juice were given to nine children in the nursery. Four of them pursed or curled their lips, 1 turned his head away, and 1 frowned. The others sat still and solemn, and kept tasting their lips attentively for some time. There were certainly individually different reactions to this bitter-sour, astringent taste. Several of the children definitely disliked it and none of them seemed to like it. It is possible then that there is a bitter taste to spinach which may in part account for children's aversion to it. Another factor, that of the dark green colour of spinach may influence older children's and adult's feeling reaction towards it. One two-year-old in the hospital on turning away and refusing to eat the vegetable was seen to point to it and say "dirty."

The *six-month-old* baby's attention is usually arrested by the presence of a stranger. His movements are inhibited and he watches the newcomer intently. He is not pleased and one could hardly say he is afraid. But he seems diffident and uncertain what to do, or utterly unable to move for a few moments. At seven months he reacts

in the same way to the approach of a stranger, though the general inhibition of movement is greater and lasts longer. After a few moments or several seconds of tension he may begin to cry slowly, or burst suddenly into tears. The whole body is usually rigid and inactive. The eyes, previously wide open, close tight and the head bends. Should the stranger touch the child he will probably turn or draw away. Here is the emotion of fear already differentiated. Frightened distress results when the child through inhibition, ignorance, or inability finds himself unable to respond at all adequately to the situation.

At *seven months* of age an infant calls out protestingly when a familiar person ceases to attend to him, instead of crying distressfully like a four-month-old. He still cries and kicks angrily if some object in which he was deeply engrossed is taken from him. He does so also after being highly excited by a playful adult when the latter goes away or stops playing with him. He now makes prolonged attempts to get at objects out of reach. If he fails to attain his objective he may give up and cry in helpless distress, or he may just grunt in protestation.

A *nine-month-old* child will struggle longer and make more varied attempts to reach the object of his desire. Should he fail to do so after putting forth considerable effort he may become tense and red in the face with anger. He will kick and scream and look for assistance, while tears flow copiously. The cry at this age is becoming exceedingly loud, and tears flow more readily than at the earlier ages. Prolonged crying at four or five months is accompanied by slight lacrimal secretion, but after six months of age tears often flow down the child's cheeks as he cries, especially after an adult's attention has been attracted.

Strangers are still quite terrifying to the nine-month-old baby. His movements are more completely arrested by the unfamiliar presence than those of the six-month-old. He will remain immovable for several minutes unless the newcomer approaches very close to him. In that case he will lie face down or bend his head and probably begin to cry. At ten months of age he may even be so frightened as to flop down suddenly on the bed and scream loudly. Then follows prolonged and tearful crying.

When children of *ten months* and over are hungry, uncomfortable, tired, or fretful and unwell, they will set up a whine or cry as the result of suggestion when another child cries. They do not, however, ordinarily imitate crying when they are occupied and happy. Under these circumstances they may call or babble in a pitch similar to that of the other child's cry. Small objects which can be manipulated interest them so intensely that they can be distracted from a distressing trouble fairly easily at this age. These objects need not necessarily be new so long as they are freshly presented.

Year-old babies often cry suddenly when they feel themselves falling, or when they lose their grip while climbing. If they miss the assistance of a helping hand they will also sit down and cry loudly. Sometimes their emotion is anger at the thwarting or failure of their endeavors. They scream, flush, and tremble in rage. At other

times they sit motionless in fright and look for aid or comforting sympathy. When strangers approach the *twelve- or thirteen-month-old* baby he may hold his hand behind his ear in a withdrawing motion and stare apprehensively. He may actually hide his eyes behind his hands or look away so as not to see the awe-inspiring or annoying intruder.

At *fourteen months* or thereabouts we may see the real temper tantrum. At least, that is the age when it became noticeable in the hospital. If a child is not given his food or a coveted toy exactly when he wants it he may respond by throwing himself suddenly on the bed or floor. He then screams, holds his breath, trembles, turns red, kicks or thrusts his feet out together. Tears flow and he will wave away anything that is not the desired object. These outbursts may occur frequently for a few weeks, or only spasmodically for another year or eighteen months. The children under observation seemed to have their "off-days" when they were fretful and easily distressed or roused to anger. Such days were usually when they were incubating or recovering from colds, when the hospital routine was disturbed, or after the children had been excited by parents' visits.

Distressful crying becomes less common as the months go by. Extreme hunger and weariness after a long day or great activity may be accompanied by whining and intermittent outbursts of tears. Anger is expressed more in protesting shouts, pushing and kicking, but less in tearful screaming. So long as adults are present, however, the interference and rough handling of another child may bring forth cries and tears. A *fifteen-month-old* may show his annoyance by hitting a child who has taken his toy or who is holding on to the thing he most wants. He may even bite him or pull his hair without a preliminary scream or shout.

The attention of familiar and interested adults is much sought by children of *fifteen to eighteen months.* If such attention is given to another child there may be signs of deep distress. The neglected one may stiffen, stand motionless, bend his head and burst into tears. Here is perhaps the beginning of jealousy, distress at the loss of, or failure to receive, expected attention and affection. Some children will show aggressive annoyance when another receives the attention they covet. They do this usually by hitting the envied child.

A *twenty-one-month-old* child will show less mistrust of strangers than will a younger infant. He may, however, run away and watch the newcomer for a time at a safe distance. After eighteen months he shows anger at adult interference by obstinate refusal to comply with their requests. He may shake his head and refuse either to be fed or to feed himself. At two he will play with his food, throwing it about instead of eating it, as a spite against some offending or scolding adult. Distress is shown chiefly at pain and acute discomfort, though the child will cry miserably at much less discomfort if a sympathetic adult is close at hand.

The children in the nursery group, *between fifteen and twenty-four months*, were more or less unconcerned when being undressed for the annual physical

examination. This part of the procedure was familiar and not unpleasant. Several of the children cried and stiffened somewhat when placed on the table in the examining room. One or two continued to show distress throughout the examination. Others smiled cheerily at the attendant nurse or the doctor, until they felt sudden and unexpected local pressure. All of the children cried at some time during the procedure. The most distressing events were when a flashlight was thrown into the eyes, and when the throat and ears were examined with the aid of the usual tongue-depressor and otoscope. The children had to be held firmly and their movements curbed during these operations.

It was patent to the observer that the children were undergoing rather different emotions according to their fast-developing individual idiosyncracies. Some were mainly startled and afraid, their movements were paralyzed. Some seemed to be just generally distressed at the unusual proceeding and the discomfort; while others were chiefly annoyed at the interference with their freedom. Several children showed signs of all three emotions. These individual differences probably have their foundation in variants in the physical constitutions of the children, both hereditary and acquired. They are certainly very much determined by the particular experiences the infants have gone through since their birth. A continuous study of behavior week by week reveals the actual differentiation and consolidation of individual traits of temperament.

Two or three of the nursery children over fourteen months developed fears for specific objects or persons. Toy animals that squeaked frightened one or two, causing them to draw away, stare wide-eyed and perhaps cry. This squeak could hardly be called a "loud low sound" such as Watson (4) describes as one of the original fear-producing stimuli. The sound is, however, rather unusual and comes at first as a surprise to the babies. One child was afraid of a particular aggressive little boy. No doubt he had gone up and hit her unexpectedly some time when the nurses were not watching. One youngster showed fear of a dark grey dog with a rough fur, rather different from the soft teddy-bears and other stuffed animals in the nursery.

Parents often remark how their children may suddenly show fear of some surprisingly trivial and inoffensive object. The answer to this may be found in certain partial associations with disturbing events of the past. It may also be found in the particular mental set of the child's mind and body when he came in contact with the object. He may have become suddenly aware of its presence and perceived it as an unwelcome intruder upon an entirely different line of thought or action. Still another phenomenon may account for the peculiar fears and objections of children. Timid behavior may be actually learned and preserved as a social asset, one of the numerous means of drawing attention.

The nursery child who cried and crawled away after touching the rough-haired, stuffed animal was flattered with the attention of all the adults in the room. A nurse brought the dog

up to the child, smiling and saying "nice doggie." He looked up at her face, saw her kindly smile, then bent his head and began to whimper again. Another nurse laughed appreciatively as he put his hand to his eye, and tried to coax him with a toy cat. He turned away quickly, cried out again, then looked up to see the effect on the adults. He was having a delightful time out of his apparent fear.

DELIGHT AND ITS DERIVATIVES

Delight is much later in becoming differentiated from general excitement than distress. The baby under a month old is either excited or quiescent. Gentle stroking, swaying and patting soothe him and make him sleepy. When satisfied after a meal he is no longer excited nor even distressed by hunger. And yet he is not positively delighted. He is just unemotionally content, and either tranquil or busy mouthing and staring at distant objects. When he is *over two weeks old* he will sometimes give a faint reflex smile upon light tapping at the corners of his mouth. This is hardly an emotional response.

One- and two-month-old babies cry and kick from hunger before they are fed, rather than show delight on presentation of the much desired food. They become calm, however, immediately when given their milk, but not at the mere approach of the adult who brings it. At two months infants will give fleeting smiles upon being nursed, patted, wrapped warmly, spoken to, tickled, or gently rocked. Perhaps this is the beginning of the emotion of delight.

By *three months* of age the emotion of delight is becoming more clearly differentiated from agitated excitement on the one hand and non-emotional quiescence or passivity on the other. The child kicks, opens his mouth, breathes faster, and tries to raise his head upon sight of his bottle. He gives little crooning sounds when being fed, nursed or rocked. He smiles when an adult comes near and talks to him; and he will even stop crying momentarily at the sound of a person's voice. He may also show delight in distant moving objects. One baby in the hospital, for instance, lay and watched the moving leaves of the creeper on the window for a minute or two at a time. Her eyes were wide and her mouth rounded and open. At times she would breathe fast, or inspire deeply, and utter murmurings of "uh-uh-uh." Her arms would wave up and down and her legs kick alternately.

The chief characteristics of delight are: free as against restrained movement; open eyes and expansion of the face in a smile as contrasted with the puckering of the forehead and closing of the eyes in distress; body movements or muscle tension of incipient approach rather than withdrawal; audible inspirations and quickened breathing; soft, lower pitched vocalizations than those of distress or excitement; more or less rhythmic arm and leg movements; prolonged attention to the object of interest; and cessation of crying. Although behavior varies in detail from child to child at successive ages, delight is always recognizable from certain general types of response. Free and rhythmic movements, welcoming and approaching gestures, smiles and vocalizations of middle pitch are most common features.

A *four-month-old* baby laughs aloud

when some person smiles and frolics with him. He smiles in response to another's smile and even when anyone approaches his crib, whether they be strangers or not. He spreads out his arms, lifts his chin, and tries to raise his body in approach to the attentive person. He takes active delight in his bath, kicking and splashing the water. Food, though sometimes welcomed eagerly, is often neglected for the more interesting attendant who talks and smiles at him.

At *five months* a child vocalizes his delight in sounds of "uh-uh-ung" in addition to waving, laughing, kicking and wriggling around. He shows special interest in small objects that he can handle and explore. Musical or noisy rattles are popular at this age. When hungry he kicks, breathes fast, and calls out eagerly at the first sign of the person who brings his food. His smiles are more transient, however, and his movements less vigorous on approach of a stranger.

By *six months* of age a child will reach towards a familiar person but will lie still and observe a stranger dubiously. He crows and coos frequently, taking pleasure in his own movements and sounds. In the hospital the babies of this age would watch each other through the bars of their cribs, sometimes laughing and kicking in response to the sight of the other's movements. They would swing their legs rhythmically when lying on their backs, or sway sideways when lying prone.

A *seventh-month-old* baby is becoming increasingly interested in small objects and in the act of reaching and grasping those close at hand. He will even struggle to attain things somewhat out of his reach. When his efforts meet with success he often smiles, takes a deep breath and expresses his satisfaction in a sort of grunt. After a moment or two spent in examination and manipulation of the object, he goes exploring again with fresh vigor. Possibly this is the beginning of the emotion of elation, exhilarating pleasure in personal accomplishments. Resting periods, after the delightful satisfaction of feeding or explorative activity, are often taken up with a rhythmical rocking back and forth, the child supporting himself on his hands and knees.

At *eight months* of age the child seems to take more delight than ever in self-initiated purposeful activity. He babbles and splutters and laughs to himself. Especially does he seem delighted with the noise he makes by banging spoons or other playthings on the table. Throwing things out of his crib is another favorite pastime. He waves, pats, and coos, drawing in long breaths, when familiar adults swing him or talk to him. He will watch the person who nurses him attentively, exploring her, patting gently, and often smiling. Here are perhaps the earliest demonstrations of affection. The child will also pat and smile at his own mirror image. But his behavior is rather more aggressive and inquisitive than really affectionate.

A *nine-month-old* baby is very popular with adults. He laughs frequently, bounces up and down and tries to mimic their playful actions. He pats others babies exploratively but does not show particular affection for them. Strange adults may frighten him at

first. But, after studying them for some time in the distance, he will smile responsively and join in play with them. By *ten months* of age the child is taking more interest in other babies. He will mimic their calls and even their laughter. The hospital babies of this age would pat and bang and laugh in imitation of each other.

An *eleven-month-old* baby takes great delight in laughter, not only his own but that of another. He will laugh in order to make another child laugh, then jump and vocalize and laugh again in response. At twelve months of age he will repeat any little action that causes laughter. He is becoming increasingly affectionate. He puts his arms around the familiar adult's neck, and strokes and pats her face. Sometimes he will actually bring his lips close to her face in an incipient kissing movement. He looks eagerly for attention; and may stand holding a support and changing weight from one foot to the other in rhythmic motion, as a solace when neglected.

Between *twelve and fifteen months* a child usually learns to walk with a little help. This performance, though often accompanied by panting and tense effort, causes great delight and even elation when a few steps have been accomplished. The child calls out, smiles and waves ecstatically (i.e. rapidly or jerkily). Without further encouragement from adults, he will then set out again with renewed fervor. When attentive adults are too enthusiastic in their appreciation, the little one may become positively tense with excitement. His efforts may consequently meet with less success, and then he cries in vexatious disappointment.

There is already a noticeable difference between the responsiveness of different *fifteen-month-old* children to demonstrated affection. Some children come readily to be nursed and petted, others require a little coaxing. One or two will kiss back when kissed, while others merely cling closely to the adult caressing them. At this age the children begin to show definite affection for each other. They take hands, sit close to one another, put their arms about one another's neck or shoulders, pat and smile at each other. Eighteen-month-olds will also jabber nonsense amicably together. Again, with regard to playmates as well as adults some children are more affectionate than others.

These variations in affection no doubt have a number of causal factors. They depend upon the child's physical constitution and his condition of health at the moment. Sick children may be very clinging and affectionate with adults, or, in some instances, refractory and irritable. They may be both by turns. Whether a child is affectionate or not also depends upon the nature of his dominant interest at the moment. Affection for a grown person depends upon the child's attitude towards adults in general; and that again is largely a matter of the amount of fondling or scolding the child has received. Affection for other children is considerably determined by the agreeable or exasperating nature of chance contacts.

Between *fifteen and twenty-one months* the children find increasing enjoyment in walking and running about. They chase each other laughingly and enjoy snatching one another's toys. They come back again

and again to adults to be lifted high or swung round. The nursery slide is very popular at this age. One or two of the hospital children pulled away and watched apprehensively in the distance after the first slide. A little encouragement from the nurses and the eager shouts of the other children soon overcame their fear, and they joined the sliding group again.

Gramophone music was listened to intently by almost all the nursery children. Some of them responded by swaying or nodding motions to time. The children at this age were beginning to find individual interests in things and to express their enjoyment each in their own peculiar way. Absorbed preoccupation, tight clasping, biting, and varied manipulation of the attractive object were common expressions of interest. Some children would knock one object against another in play, some would collect things, and others would find pleasure in throwing and scattering toys about. These variations in appreciative interest in things and activities may be the precursors of the more mature emotion of joy.

Most of the eighteen-month-olds in the hospital were anxious to attract attention. They called out or came running to greet an adult. They would smile and hold out their arms to a familiar nurse in expectation of being lifted. A stranger they would watch solemnly for a while. Then they would approach slowly, touch and explore her clothes, or hit and watch for the effect. The children seemed to recognize their nurses at this age, whether the latter appeared in uniform or not. Babies of seven to twelve months, however, would sometimes turn away in fear or hostility when the nurses approached them wearing outdoor clothes.

Slight preferences for certain nurses were noticed as early as six months, but definitely affectionate attachments were observed chiefly between the ages of twelve and twenty-four months. One or two youngsters of eighteen months showed preferences for certain playmates. A twin boy and girl seemed especially fond of each other. The children would be more responsive and playful with those they liked, more delighted at their approach and very anxious to keep them close. Some children were friendly with almost everybody including strange visitors. Others showed more specific and decided likes and dislikes. When a terrifying stranger was present, some times a child would show more than usual affection for his familiar nurse, but at other times he would be restrained and aloof from everybody. Similarly when a beloved parent was nursing a child on visiting day he might be hostile to anyone else; but more often he would smile agreeably at everybody including awe-inspiring strangers.

A specific "like" does not necessarily enhance a specific "dislike" by force of contrast, though this does sometimes happen. If the disliked object threatens the satisfaction or enjoyment of the object preferred then the dislike becomes stronger. Similarly a preferred object may be enjoyed with greater intensity in the presence of, or following upon, something disliked. It is a comforting relief from distress. This effect of contrast is perhaps what

Freud terms "ambivalence." There are situations, however, where it has no noticeable effect. For instance, as cited above, a child made happy by one person may like everybody for the moment, regardless of previous attitudes towards them. A troubled child may be annoyed with everybody, even his favorite playmates. Strong emotions may thus have a decided "halo" effect.

Although children between *eighteen months and two years* of age tease and hit each other frequently, they show more affection for one another than younger infants. They not only pat and stroke fondly, but they will kiss and hug each other on occasion. The older children in the nursery group were seen to direct the younger ones' activities and point out their errors by gesture and exclamation. There was no evidence, however, of the parental affection and almost self-sacrificing care shown by four-year-olds for their much younger playmates.

Noisy activities delighted the eighteen- to twenty-four-month old youngsters. They took pleasure in tearing and pulling things to pieces and in lifting large but portable objects, such as their own chairs. They jabbered happily to each other at table. One child would repeatedly make strange noises to arouse the attention and laughter of another. With adults they would practice newly learned words and would seek to share their enjoyments. When the children received new toys in the hospital they would cling to them and guard them jealously from the other children. But they would hold them out for the nurses to share in their appreciation. Here is a mark of trusting friendship for their kindly guardians such as the children had not yet developed for one another. They would always rather share the other child's plaything than give up or share their own.

Affection, thus, begins as delight in being fondled and comforted by an elder. It becomes differentiated from general delight and manifested in tender caressing responses at about eight months of age. This earliest affection is essentially reciprocal in nature. Spontaneous affection for adults may be seen, however, by eleven or twelve months of age. Both reciprocal and spontaneous affection for other children make their appearance around fifteen months, but they are not as strong as affection for adults.

Specific affection for the grown-ups who give special attention may be manifested as early as demonstrative affection itself, i.e. eight or nine months. These preferences persist as long as the care and attention continue. Attachments between two children were not observed in the hospital till after fifteen months of age. They were usually very temporary, lasting only for a few hours or days. The behavior of a child-friend is so much more erratic and less dependable than that of an adult. Friendships between eighteen- to twenty-four-month-old children would sometimes last, however, for several weeks. There seemed to be no preference in these attachments either for the same or the opposite sex. Little girls would become friends together, or little boys, or a boy and girl would show mutual affection for one another.

SUMMARY AND CONCLUSION

The emotional behavior of young infants as observed in the Montreal Foundling and Baby Hospital seemed to lend support to the writer's theory of the genesis of the emotions. Emotional development was found to take place in three ways. The different emotions gradually evolved from the vague and undifferentiated emotion of excitement. The form of behavior response in each specific emotion changed slowly with developing skills and habits. Different particular situations would arouse emotional response at succeeding age-levels, although these situations would always be of the same general type for the same emotions.

The one-month-old baby showed excitement in accelerated movement and breathing, upon any excessive stimulation. He exhibited distress by crying, reddening of the face and tense jerky movements at painful and other disagreeable stimulations. But he was more or less passive and quiescent when agreeably stimulated.

By three months of age the child was seen to exhibit delight in smiles, deep inspirations and somewhat rhythmic movements when his bodily needs were being satisfied. Between three and four months angry screaming and vigorous leg-thrusts, in response to delay in anticipated feeding, were observed. A few weeks later anger was aroused when an adult's playful attention was withdrawn.

Distress and delight came to be expressed more in specific vocalizations with increasing age. General body movements gave place to precise responses to details of a situation. A four-month-old baby would laugh aloud with delight and cry tearfully when distressed. A child of five months was seen to cough and reject foods of a certain taste and consistency in incipient disgust. He would reach towards objects that caused him delight. By six months of age he showed definite fear when a stranger approached. He remained motionless and rigid, his eyes wide and staring. It is possible that "non-institutional" children might show fear in response to other unusual or unexpected events a little earlier than this. There was little variation in the daily routine of the children under observation, and fear was a rare occurrence.

By seven months of age the child showed positive elation, and renewed his activity as a result of success in his own endeavours. At eight months he began to show reciprocal affection for adults, and by twelve months spontaneous affection. Delight was manifested in much laughter, bouncing up and down, and banging with the hand.

Between nine and twelve months of age the hospital babies would hide their heads, like ostriches, upon the approach of a relatively unfamiliar person. They would scream and become flushed with anger when their efforts or desires were thwarted; and they would cry out in fear and sit motionless after perceiving themselves falling.

It was observed that a child learns to kiss soon after twelve months of age, and by fifteen months he expresses his affection for other children. Anger over disappointment becomes more dramatic in its manifestation. The true temper-tantrum makes its

appearance roughly about fourteen months of age. By eighteen months anger at adults is expressed in obstinate behavior; and annoyance at interfering children is manifested in hitting, pulling and squealing.

Eighteen-month-olds would constantly seek the attention of adults, and take great delight in running about and making noises. One or two children of this age showed depressed, and others angry, jealousy when another child received the coveted attention. A few specific fears were noticed; and several children developed particular affectionate attachments.

Thus it seems that in the course of development, emotional behavior becomes more and more specific, both as regards arousing stimuli and form of response. Distress, though more readily aroused, comes to find adequate expression in a variety of actions, and delight becomes sensitive appreciation and joy in numerous pursuits. The emotions, evolve slowly, and the exact age of differentiation is difficult to determine.

A diagram showing the approximate ages of the appearance of the different emotions, as observed in the Montreal Foundling Hospital, is given in figure 1. Study of a number of children in private homes might suggest a somewhat different age arrangement. Readers of the Journal of Genetic Psychology will note that a greater number of different emotions are attributed to the two year level than were suggested in a previously published diagram, (3) based on a study of nursery school children.

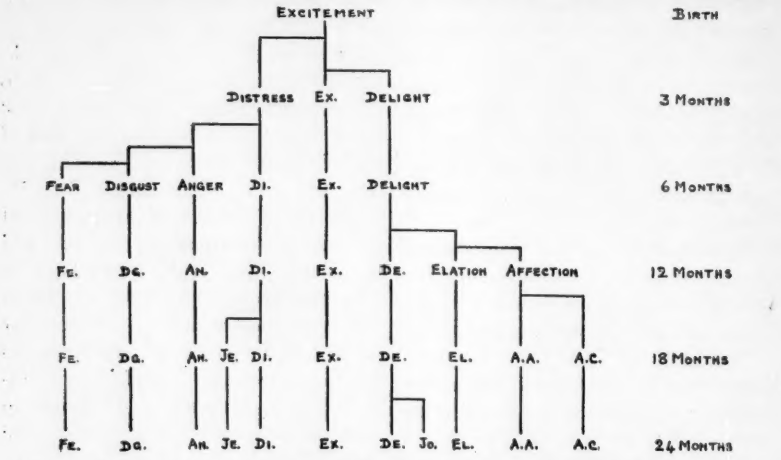

FIG. 1. SHOWING THE APPROXIMATE AGES OF DIFFERENTIATION OF THE VARIOUS EMOTIONS DURING THE FIRST TWO YEARS OF LIFE

Key: A.A. = Affection for adults, A.C. = Affection for children, An. = Anger, De. = Delight, Dg. = Disgust, Di. = Distress, El. = Elation, Ex. = Excitement, Fe. = Fear, Je. = Jealousy, Jo. = Joy.

Emotional behavior and development are very much determined by particular events and experiences and the routine of living. It is, therefore, to be expected that "institution babies" will show some deviations in their reactions from those of children at home. The former will probably exhibit fear of a larger number of things than other children, due to their very limited experience. On the other hand, they may show greater tolerance of interference, as a result of much practice in self-control in the nursery. They may also be more affectionate with other children, in consequence of the many happy play-hours spent together.

The daily round of feeding, washing, dressing and sleeping, however, has so many factors in common for all babies, that the observations made on the emotional development of a few hospital children, and the suggested inferences presented above, may have at least some general significance for infants brought up under other circumstances.

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Fiction as a Guide to Child Development

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BEFORE entering upon the discussion it seems desirable to distinguish the use of fiction as treated in this paper, which is a very specialized use, from other possible and legitimate purposes. Fiction suggests imaginative fashioning. Fiction may deal with reality or it may shun reality. A writer may endow his actors with any type of quality—human, superhuman, or subhuman. All that the reader demands is that the players become characters. Fiction may mirror life or it may mirror a highly imaginative creation of the author. It is principally a work of art.

When fiction is resorted to as source material in child psychology, however, a function is implied that is essentially foreign to the major purpose. If, for example, the children of the story are characterized by a critic as living boys and girls whose behavior is to help us realize what goes on in the child's mind and thus to help us understand children, then the extent to which the behavior sequences are those actually found in children becomes important. Unless the material is valid, that is, in accord with what is known about children, it cannot be recommended without qualifications. The importance of this statement will be illustrated by the following analysis.

A piece of fiction that has recently attracted considerable attention is Lichtenberger's *Trott and His Little Sister* (1). The author is given credit for being "perhaps the first to use with little children the arts and devices of serious, respectful, attentive observation and divination which make possible the depiction of adults in fiction. And, of course, observation and divination are the two mainstays of what we think we have invented—child-psychology study. . . . . Trott is charming, lovable, and touching without stepping for a moment beyond the narrow limitations of a child's undeveloped personality." (pp. 6 and 7)

A recent review of the book (2) expresses a similar idea: "While in dress, manner, and training Trott has all the quaintness of a past generation, in emotion, attitudes, and behavior he is thoroughly human and real and, therefore, essentially modern. . . . .This book is as good mental hygiene as anything that is published on young children and far better literature than much that is written in this field."

On the basis of such recommendations as these, the book might easily be accepted by parents and students as a guide to securing a better understanding of child behavior and consequently lead them to expect similar capacities and responses on the part of those children with whom they come in contact.

To obtain an estimate of the agree-

ment of the behavior sequences attributed to Trott and his little sister with our present knowledge of child psychology, the writers prepared a detailed analysis of a sample consisting of three chapters selected at random. The analysis was carried out as follows: The descriptions of the behavior of the children were blocked off into items of convenient size; each item was then examined in the light of its setting and rated as plus, questionable, and minus depending upon whether the behavior sequence represented a possible, questionable, or highly improbable situation. The analyses and ratings were made by two critics working independently.[1]

An application of this procedure is indicated in the following passage reproduced from Chapter 20.

Rating	*Description of Behavior*
	"Papa is a sailor. He knows that nothing can resist the unfettered elements. The wise man allows the tempest to pass and returns to his task later. Therefore, with the voice of humiliation, he counsels retreat.
+	(*Mlle. Lucette follows the fateful pen with her eyes until it has left the room*)
−	(*Clearly, defiance, complete defiance, possesses her*) But lo! (*Suddenly her*
+	*eye lights up and a flood of gracious prattle pours from her lips*).
	"Enormous, triumphant, serene in her power, Nounou has reappeared
+	and (*baby throws herself at her*)
?	(*anxious to find on her breast forgetfulness and consolation*).

The first part of the paragraph describes the father's behavior and is, therefore, not analyzed. The descriptions of the child's behavior are underlined and blocked off by enclosing in parentheses. The ratings of the items are given at the left.

A factor which made it difficult for the raters to judge the validity of the behavior sequences consisted in the author's failure to make a definite statement as to Trott's age. The most indicative factor of a concrete nature which could be discovered is the fact that Trott was just beginning to lose his teeth when the little sister's first tooth appeared. Thus it is reasonable to suppose that Trott was approximately in his seventh or eighth year when the sister was approximately seven or eight months of age. Since 2 winters are mentioned in the chapters describing Trott's activities before the arrival of his father after a long absence, and since Trott was told about the expected arrival at the beginning of still another winter it was assumed that Trott was approximately four or five years of age at the beginning of the story.

The analyses revealed four types of assumptions relative to child behavior which were judged as questionable or highly improbable. Foremost among these is the ability of the young child to generalize to the extent which the author attributes to Trott. Especially does this boy of four or five years generalize as to the characteristics of adult behavior as compared with child behavior and the differences in what appear to be proper standards of conduct for adults and children. During a social tea in his mother's drawing room Trott not only accepts the fact that he cannot have tea and cakes

[1] Dr. Esther Van Cleave Berne of the Iowa Child Welfare Research Station served as the second observer in making the analysis and the writers wish to express their appreciation for this assistance.

which are "very good for grown people," but he also recalls and reflects upon other instances which comprise certain behavior responses acceptable on the part of adults but not for children. Among such instances called to mind by Trott are such situations as the repetition of slang which is evidently quite proper for adult use, the difference in the amount of conversation permissible, the matter of tearing clothes, and behavior in church, all of which seem to indicate the existence of different standards for adult and child behavior. These instances, requiring no small amount of insight and judgment, comprise, in part, Trott's thinking while the ladies are chatting, and he concludes that these differences in conduct standards must be accepted as "something established, inevitable, a law one must bow to." (1—p. 12)

Later when Trott is approximately eight years of age he "pities his little sister and admires her patience" when visiting ladies insist upon inserting their fingers into little sister's mouth and feeling the new tooth. "It must be exceedingly aggravating." Then, however, Trott generalizes quite remarkably, "Well, to each age its trials." After the little sister's refusal to accept the new diet, Trott is not only nonplused, but "he has a foreboding that tomorrow it may be the same thing, and the next day also" concluding with the rather whimsical generalization that "life is a very complicated affair." In the chapter from which the last excerpts were taken, Chapter 20, approximately 13 per cent of the total number of behavior items are related to such generalization processes.

Another departure from child psychology is exemplified in the child's resistance to a tremendous amount of social pressure. The author attributes to Trott at the age of four or five not only unusual preceptual and ideational abilities when he gives the child the ability to comprehend the social chatter and gossip of adults and to reflect upon it, but he also enables Trott to react to the injustice of snobbish criticism, class distinction, and social ostracism of a former member of the particular social clique represented by his mother and the other ladies at the tea.

Assumptions of a questionable nature also are those assigning powers to Trott which enable him to judge from adult standards certain acts and verbal expressions as being ugly and characteristic of ill-bred children. Moreover, he is given the ability to detect from facial expressions and mannerisms with unerring accuracy such attitudes and reactions as lack of understanding, assent (from the eyes), wistfulness, and worry.

The author also causes Trott to react inconsistently in his conversations with "the poor little boy." He presents a curious mixture of precocious, critical judgments as to the truth of the poor boy's statements and the ordinary questioning processes so characteristic of children of Trott's age. Rapid, unusual rationalization processes occur in a few seconds of stress when Trott discovers that God has left no roll in the hole under the rock where the boys had prayed that it should be left. (God was too busy, or he had forgotten, or the rolls burned, and it would have been better to have left one even though it were burned.)

A few statements as to the little sister's development should be included. Lucette "had been in existence only three days when she could distinguish perfectly night and day, light and dark." It is probable that the infant was sensitive to varying amounts of light and dark, but that is all. Soon Lucette "began to be naughty on purpose." While Trott was attempting to amuse his little sister during the introduction of the new diet, Mlle. Lucette "regards him coldly with a look of disdain which unmistakably says 'Contort yourself as you please, I am not your dupe.'" After the removal of the refused food, "Clearly, defiance, complete defiance possesses her." Such statements as these imply on the part of an eight month old infant an understanding of social behavior, motives, and attitudes which is unwarranted. The necessary perceptual and ideational abilities are not sufficiently developed at this early age to permit such comprehensive understanding.

These examples taken from the results of a detailed analysis indicate the limitations in the use of this type of fiction that must be recognized by teachers and students.

Similar examples could be taken from other works but the results of the foregoing analysis are sufficient to illustrate our point. Before any novel is recommended as a source of principles of child psychology it should be carefully analyzed to determine to what extent the characters are real children and to what extent the author uses them for his convenience to create the story or to express a generalization which may hold true in adult life, but which does not necessarily take cognizance of child development.

In conclusion, the writers wish to remind the reader that they are not challenging the value of this nor of any other piece of fiction. *Trott and His Little Sister* is indeed a charming story and exceedingly interesting. As a story and a creative piece of art it ranks high. To recommend it without qualifications for use as child psychology material is superimposing a function for which the book was never intended. When it is viewed from the point of view of this unusual function it is, therefore, not surprising that there are limitations. But these limitations do not apply when the narrative is considered in the light of the major purpose of fiction—to present a creation of the author.

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Clinical Identification of the Prospective Non-reader

LORENE TEEGARDEN

THE tendency to reverse and confuse symbols in reading is believed to be one of the prime causes of failure to learn to read, in a child whose intelligence and vision are normal. Confusion of symbols through failure to distinguish their exact position and sequence makes reading difficult; difficulty without adequate appreciation and help in overcoming the trouble produces failure; and failure produces dislike and antagonism. The result is the non-reader, the child who after several years of the usual school instruction has not learned to read though he seems normal in alertness, interest, and activity in other things.

"But why identify the non-reader clinically?" some may ask. "He identifies himself. You can not miss him when you have him in a class. What we need is methods for teaching him to read."

Yes, but even more we need methods for identifying him before he becomes a failure, and for giving him the special help that will save him from the searing experience of failure, and enable him to learn to read at the proper time.

This report presents a study conducted for the purpose of identifying in the first few months of school the child who is in danger of becoming a non-reader because of a strong tendency to reverse and confuse symbols in reading.

PLAN OF THE STUDY

1. Tests were devised to measure the tendency to reversal in children just entering first grade.

2. From the results of these tests 50 children were selected for individual study, ranging from those who had exhibited a strong tendency to reversal, through all levels to those who revealed no such tendency.

3. The individuals selected were studied clinically by means of standardized psychological tests, and special tests devised to examine types of reactions which it was thought might be related to the reversal tendency.

4. At the end of the year standardized primary reading tests were given in order to (1) measure the actual progress in reading; (2) correlate reading achievement with scores on the reversal tests given the previous September; and (3) to compare reading progress with the various types of clinical pictures revealed in the individual studies.

Reversal tests

Full details of the group tests for the tendency to reversal are not re-

ported here. A review is given of the general plan of the tests and the results. The battery included 4 tests, only two of which were used in computing the reversal score.

1. Writing letters or digits from memory. This was intended to reveal something of the child's previous experience and familiarity with symbols. Because of the varying factor of experience it was not included in the reversal score, but it gave valuable clinical information about the child.

2. Matching script letters and digits. Fifteen of the most confusing characters were mimeographed in duplicate on a sheet of paper, arranged in different order in two vertical columns. The children were told to find those that were exactly alike and to tie them together by drawing a line between them. This test was not scored, but was used as a preliminary practice test, to insure accurate and dependable results from a similar test of matching printed letters and digits.

3. Matching printed characters. Similar in plan and procedure to test 2. Given after test 2, the instructions were better understood, and we could be sure that each child was trying to do the thing that was required of him. This test was scored.

4. Copying of nonsense characters. In order to avoid the complication of experience, ordinary letters and digits could not be used. Nonsense symbols were devised, presenting many combinations of loops, lines, and curves, varying in difficulty from a single loop and line to some that were difficult enough to tax the ability of the best six-year-old.

Scoring of the tests was based on the plan of plus credit for correct work and minus credit for incorrect matching and reversals in copying. Each child, then, made a positive and a net score. The former was the total of correct work, the latter was what remained after subtraction of the minus credit for errors. The sum of positive and net scores for both tests was called the sum score, and was used as the measure of achievement level in the reversal tests. A quotient score, computed by dividing the net score by the positive score, was used as a measure of accuracy in the work attempted. For a performance free from errors, the quotient score was 100, while the sum score. determined by the amount of work attempted, might be high or low.

The reversal tests were given in September during the second and third weeks of school to 258 children just entering first grade, including 135 with kindergarten training and 123 without. Children repeating first grade work were eliminated in order to make more constant the factor of experience.

Scores on the tests were arranged in order from best to poorest and 50 children were selected who were scattered throughout the range. Thus we attempted to secure for comparative clinical study children with all degrees of the tendency to reversal and confusion of symbols. These children were examined between late October and the middle of December of their first semester in school.

The clinical examination

The Stanford revision of the Binet scale was used in complete form, with

one addition in procedure. For the counting of 13 pennies record was made of the hand used by the child, and the direction in which he moved in counting.

sought. For this a simple gravity toy was used, called "Bizzy Andy, Jr.," and manufactured by the Wolverine Manufacturing and Supply Company, Pittsburgh. It is obtainable in

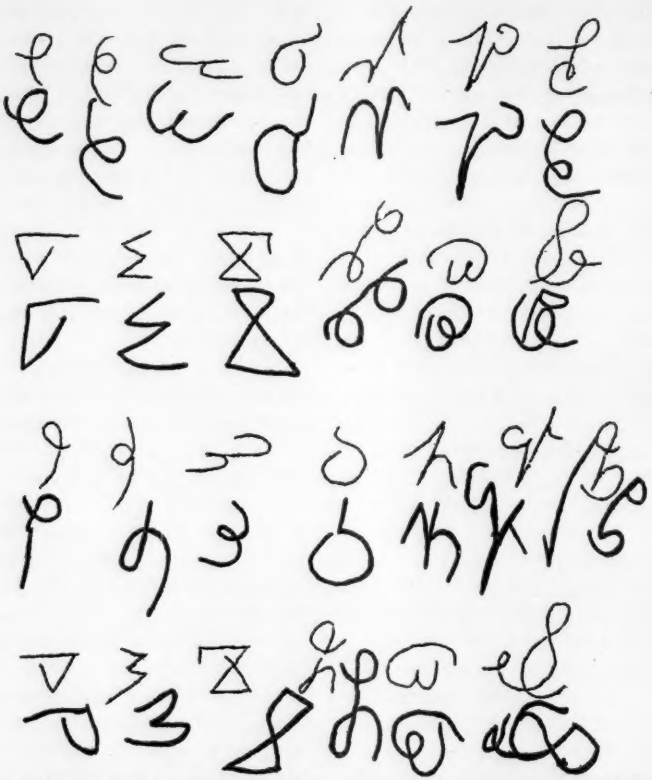

FIG. 1. ILLUSTRATION OF NONSENSE CHARACTERS AND A CHILD'S COPY OF THEM

The Seguin-Goddard formboard was the only standardized performance test used. Careful record was kept of the hand used, and the accuracy as well as speed of each performance.

A more exacting test of manual dexterity than the formboard was

almost any ten cent store. The toy consists of an oblong metal pan into which is fitted in a slot at one end an upright which holds at the top a sloping metal chute long enough to hold a row of eight marbles which are kept from rolling out at the lower end

by a protruding piece of metal on either side. The lower end of the chute is directly over the middle of the pan. The upright is pierced by a slot in which a lever is swung on a bar. The short end of the lever is weighted with metal so that it is down when the toy is idle. The other end comes up to meet the lower end of the chute, and a tongue on the end of the lever protrudes through a notch in the chute so as to lift the first marble and cause it to roll over the metal obstruction which held it, into the end of the lever, which is hollowed to receive it. With the weight of the marble this long end of the lever drops, and the marble rolls into the pan below, whereupon the lever flies up to receive the next marble, which has rolled down to the end of the chute. Thus the swinging lever continues to drop marble after marble until the chute is empty.

Two containers filled with marbles were placed, one on either side of the toy and equally distant from it. The child was told to take marbles from the containers and fill them into the chute as fast as the lever emptied it, and see how long he could keep the toy going without letting it empty the chute. Some children had seen the toy before, but none had ever used it in this way. No suggestion was made as to how the marbles should be handled, singly or by handfulls, but the child was urged to "keep it going."

The operation was repeated until 3 trials had been given. If a child could keep the toy going until the pan was full, about twenty-five marbles, he could keep it going indefinitely. Sometimes a child began by using one hand and as he found himself getting behind he brought the other hand into play. Sometimes he used one hand on one trial and the other the next time. Sometimes he changed hands in the course of the same trial. The challenge to speed, it was believed, brought out the child's best effort and revealed something of his native handedness. No attempt was made to standardize the test as a measure of manual dexterity. Record was kept of the hand used, the number of marbles successfully handled, and a comment on care and accuracy of handling, in each trial. Thus the child's record showed which hand he used at first, what he did when he wanted to work faster, and how well he succeeded with each method used.

The results showed a variety of combinations. Approximately one half of both the kindergarten and non-kindergarten groups used the right hand with perhaps a little help from the left. In the non-kindergarten group one fourth used the left hand, one tenth used both hands, and the remainder used the right hand in some trials and both in some, left and both, or left in some trials and right in some.

In the kindergarten group only a tenth used the left hand exclusively as against a fourth of the other group. One fifth used both hands, as against one tenth of the non-kindergarten group, and the remaining fifth used the hands in various combinations, now left, now right, now both.

The examination included a test of eye coördination. A fountain pen was moved before the eyes, and the child was told to follow it with his eyes and not let it get away. Only two or three

children were found who had any difficulty with eye coördination.

Eye dominance was tested with a manoptoscope. The child was shown how to hold it. Then the examiner walked to the other end of the room and told him to look at her. He was told to put it down and record was made of the eye used. Six trials were given in all. The first 2 times no comment was made as to which hand should be used. The third time he was told to use the right hand, the fourth time the left, the fifth time both hands, and the last time no direction was given. Every variety of dominance was found, from consistent right dominance through the different degrees of using now one eye, now the other, to consistent left dominance.

The spontaneous tendency to turn left or right was also made the object of inquiry. It is conceivable that some innate organization in the nervous system might produce such a tendency toward the right or left, which might be associated with right or left dominance, and with ease or difficulty in establishing the proper habits of eye movement in reading. A maze was used in order to examine the child's reaction in turning right or left. The maze as used in this study was not intended to puzzle the child or to test his tendency to look ahead and use foresight. It was an arrangement of pathways which repeatedly offered a choice of equivalent right and left turns. Whichever way the child turned, the path was equally clear ahead. Five such choices were offered in the course through the maze, with the possibility of six if certain turns were made.

Usually there was no question about which way to go, but one boy said to himself, "Will I take the left turn or the right?" I'll take the left and then the right." This alternation occurred in a total of 6 children out of 49—two non-kindergarten and four kindergarten. Three children turned always to the right, 4 turned only to the left, and others turned left and right in varying proportions. It was not possible to tell with certainty what prompted the turning, and the test was thought to be somewhat unreliable. Yet its results in many cases do fit into the picture presented by the other tests.

The last test on our list was one devised to examine direction and organization in reaction to symbols. Twenty-five simple drawings of common objects were arranged in 5 lines and columns on a card, and the child was told to name all of them. Five such cards were used, with the objects arranged in varying orders and positions, in order to check on reliability or changes in the reaction. If the subject reacted in the same manner to the first 3 cards the test was stopped. If the first 3 reactions were not uniform 5 trials were given. For each trial record was kept of the order of naming.

The lowest level of reaction was marked by total lack of system in naming. The child might begin anywhere and jump to any other picture on the card, or he might use one plan for two rows, then another, and another. Four kindergarten and four non-kindergarten children, approximately one sixth, showed lack of system in the first trial. Of these, 2 kindergarten and 3 non-kindergarten devel-

oped a systematic attack in later trials. For the unsystematic attack which was not improved, no credit was given.

For a systematic reaction one point credit was given if the same system was maintained through three tirals, or through the fourth and fifth in case it was the result of improvement in reaction. The system might be of different kinds: vertical strephosymbolic, lateral strephosymbolic (up and down or back and forth), naming by rows or by columns, or in a spiral movement. Two children from each group showed system without having either sweep or lateral direction. A reaction showing system without other features would be one in which the movement was vertically strephosymbolic, i.e., up one row and down the next, or vice versa.

For lateral direction of movement one point was given. This movement was considered superior to vertical movement in its significance for reading. Lateral movement might be strephosymbolic (back and forth) or it might also show sweep.

Sweep, which received a credit of one point, was the movement from the end of one line back to the beginning of the next, whether in a lateral or vertical direction. Six kindergarten and two non-kindergarten children showed sweep without lateral direction, that is, the movement was vertical but each row was begun at the same end.

Left-to-right movement was credited one point. Lateral movement, even with sweep, would not necessarily be movement in the right direction, though usually this combination did move from left to right.

The combination of lateral movement with sweep, in the left-to-right direction, and beginning at the top of the page, was given one point. This was the optimal reaction in naming from the cards. The maximum score of 5 points was made by 17 kindergarten children out of 27, and 12 non-kindergarten children out of 23. Three kindergarten and two non-kindergarten children fumbled on the early trials but later adopted this system and did not depart from it, thus gaining the full credit.

Improvements of reaction in the course of the 5 trials were of interest. Two kindergarten children began with an unsystematic reaction and later adopted system, one of them even making an optimal performance. Two non-kindergarten children began with a system so poor that it could scarcely be credited, and improved to the optimal reaction. Five cases, four kindergarten and one non-kindergarten, who employed system from the first, but lacked either lateral direction or sweep, were able to add that feature and maintain it, two of them thereby making a maximum score. A total of 6 kindergarten and 3 non-kindergarten children improved their reaction during the course of 5 trials. In no case was there a regression to a lower level during the test.

The naming test was significant in its close relation to the quotient score made by the child on the group tests for reversal tendency. When the quotients were arranged in order it was found that of 17 kindergarten children with quotients from sixty-seven to one hundred, all but one gave an optimal performance in naming. Of 10 non-

kindergarten children with quotients from sixty-four to one hundred, 9 gave an optimal performance. Below these points, 8 out of 10 kindergarten and 10 out of 13 non-kindergarten cases gave an inferior performance.

This test gives different results at different stages in the process of learning to read. At the end of the year it was given to almost 300 children completing first grade work. The vast majority of these children gave an optimal performance, and most of those who did not progress from left to right with sweep, named down each column in turn, beginning at the left. What the results would be if the test were given in September at the same time as the reversal tests, will have to be determined by further research. Perhaps an even closer relation to the quotient score might be revealed, or the dividing point between optimal and imperfect performance in naming might fall at a region higher in the scale of quotients.

The final step of the study for identification of the prospective non-reader was the application of a criterion, that of actual reading achievement. Late in May, when the children were nearing the end of their first year in school, the Gates primary reading tests were given. In the presentation of findings from the clinical study, the quotient score, the intelligence quotient, the Gates reading level expressed in school grade for which the score is average, and the condition of right or left lateral dominance in terms of hand and eye, will be considered. It will be remembered that all children were in the first grade for the first time. Their ages therefore ranged from a few months under six to a few months past six, and was fairly uniform. As for kindergarten experience or lack of it, the two groups will be considered separately.

RESULTS

Table 1 shows combinations found clinically in the kindergarten group of 27 children. Each case is described by a formula of which the first number gives the quotient score on the reversal tests; the second gives the I.Q., and the third indicates the grade for some stage of which the reading score in the Gates tests was an average score. A case called right dominant (or left dominant) is one in which the child uses the right hand and right eye either exclusively or predominantly, and turns right in the maze at least half of the time. Cases designated as right (or left) dominant except maze, are those in which the hand and eye preference agree, but the maze performance does not. Right hand-left eye indicates preference for the hand and eye indicated. Then there are the groups of children who use both hands readily and prefer the right eye, the left eye, or use either eye without preference.

The largest group in table 1 is the group who used either or both hands, and the right eye, seven cases. In this group is one child with a very low quotient, poor intelligence, and a reading performance that was practically nil. The child with the quotient score of 67 came just at the dividing line between optimal naming performance and less than optimal. His performance, however, was a perfect one, his intelligence was good, and he was able at the end of the year to make a reading score that was average for some stage of 1A work —not better than average for the end

of 1A. Of those whose quotient scores were up in the 80's all made reading scores above average for the close of 1A, their relative progress being roughly commensurate with their intelligence.

The 4 cases who used both hands and the left eye show something similar. One quotient was below the 60's, the child had just average capacity, and scored just average for 1A work. The next case, quotient 69, may be compared with quotient 67 of the group previously discussed. Both quotients are very similar, the condition of lateral dominance is very similar, but the intelligence varies, and the child with the better mental functioning makes better progress in reading. This illustrates a relationship which appears repeatedly in the study. Other things being equal, intelligence is the determining factor. But there are so many other things!

Continuing down the list of ambidextrous cases using the left eye, the last two again illustrate the principle just pointed out. These two children with a similar degree of reversal tendency, as shown in their quotient scores, differ in intelligence, and the more capable child makes a reading score a grade higher than the other.

Now in this same group, compare the 2 children with similar intelligence, an I.Q. of 124. The child with the quo-

TABLE 1

Combinations found clinically in kindergarten group

Comparison of dominance of hand and eye with quotient score RS, intelligence IQ, and reading achievement RL. (Cases are described by a formula giving quotient score/intelligence quotient/reading level.) 27 cases.

Right dominant—6 cases RS IQ RL 55/104/2B 76/103/Unknown 100/ 94/1A 87/108/2B 100/100/2B 94/111/Excellent	Ambidextrous—Right eye—7 cases RS IQ RL −300/ 73/less than 1B 67/109/1A 87/103/2B 87/106/2A 84/126/1A (work deteriorated) 84/124/3B 86/121/3B
Right dominant except maze—5 cases −10/ 94/1B −70/110/2B 39/115/1A 88/110/2B 100/103/2B	Ambidextrous—Left eye—4 cases 54/ 97/1A 69/124/2B 91/104/2B 97/124/3B
Left dominant except maze—1 case 85/ 94/1A (L for writing)	Ambidextrous—Both eyes—2 cases −11/101/Unknown 45/122/3B
Right hand—left eye—2 cases 65/109/1A 94/117/3B	

tient score of 69 falls far behind his mate with the quotient of 97. The strength of the tendency to reversal counts heavily in affecting the progress of children whose lateral dominance and intelligence are similar.

Let us now examine the right dominant groups. The first thing we notice is the total absence of I.Q.'s running above 120. Every child with an I.Q. over 120 is in one or another of the ambidextrous groups.

In the right dominant groups, the high quotient scores accompanied by better than average intelligence all make reading scores which are average for some stage of 2B work. Note that here we have no extremely high reading achievement levels. Right dominance, even though free from reversal tendency, is unable to achieve those high levels in the first year of school unless accompanied by unusually efficient mental functioning, or rather, by higher mental age. Two children of low quotient scores, −70 and 55, also made 2B scores, but the one who had to overcome the stronger tendency to reversal had the better intelligence, which may be what enabled him to attain that level.

There are here two children with an I.Q. of 94, slightly below average. One of these, free from the tendency to reversal, did average 1A work. The other, with a minus quotient, made only a 1B score—another demonstration that other things being equal, the stronger the tendency to reversal, the less the achievement in reading.

The first of these two children, the one with the high quotient, may be compared with the one case of left dominance. Both show consistent lateral dominance, one right, the other left. Both have a similar degree of the tendency to reversal, and both have similar intellectual capacity. Both made scores that were average for some stage of 1A reading. Compare them now with an ambidextrous child who uses the left eye. There is one of this sort, with intelligence a little better than theirs, an I.Q., of 97. But the ambidextrous child has been able to overcome a stronger reversal tendency (quotient 54) and still make an average 1A score. This points to ambidexterity as an asset.

There are two children who used the right hand and the left eye. They showed a difference in both reversal tendency and intelligence, the same child having the advantage in both factors. As a result he outdistanced his mate by a grade and a half at the end of the year's work.

The first of these 2 children may be compared with others of similar I.Q. (about 109) in other groups. There is a right dominant child of 108 I.Q. His quotient score is higher and he achieves more in reading than does the child who uses the right hand and the left eye. So it is also with one of the two children in the other right dominant group (right dominant except maze) who have 110 I.Q. The other of these two has a record that contradicts—or was his poor performance on the group tests an accident?

Other comparisons of this kind could be made. They indicate the operation of three factors in the process of learning to read: intelligence, lateral dominance, and reversal tendency.

The significance of intelligence is clear. Other things being equal, the

better the intelligence, the better the reading.

Ambidexterity operates in two directions. We have seen, and we shall see again in the non-kindergarten group, that the child of low mental age shows little preference for either hand and reveals lack of lateral dominance. We have just seen that the very bright child of six to six and one half years, whose mental age is up to seven or eight, is likely to be ambidextrous, but uses one eye consistently. There seems to be a stage between, where many of the children of I.Q. below 120 pause, at least until they are well past the mental age of seven. Of 16 cases of kindergarten trained children whose I.Q. was 100 to 115, nine were right dominant or left dominant, four were ambidextrous and used the right or the left eye, two used the right hand and the left eye, and one, with a strong reversal tendency, was ambidextrous and used either eye without preference. So ambidexterity seems at first to be a mark of immaturity characteristic of the lower mental age. It is then replaced by the acquisiton of skill with one hand or the other, and the very bright child proceeds to acquire, or to continue equal skill in both hands for manual acts, though restricting writing to one hand.

The third of the factors in learning to read, the tendency to reversal, like intelligence, stands out clearly from our analyses. Other things being equal, the child with the low quotient score makes slower progress in reading. This can not be carried too far. A difference of a few points in quotient is no difference at all. But a difference of 20, 30, or 40 points is frequently found to have a significant relation to difference in reading progress, if other factors are fairly equal.

Non-kindergarten children

Children without kindergarten training are grouped in table 2. Again the largest group includes those who are ambidextrous and use the right eye. The right and left dominant groups, which were 44 per cent of the kindergarten cases, are here only 25 per cent.

In the ambidextrous group using the right eye, we find practically the same conditions that were found in the kindergarten group. The 2 lowest quotients were accompanied by intelligence of low average or lower than average grade, and neither child made a score better than average for some stage of 1A reading. Next come 2 children with similar quotients and quite different intelligence. The reading in these two cases is inversely proportional to the I.Q., though it agrees with the very slight difference in quotient score, a difference which however is too slight to account for the difference in reading achievement. We may comment in passing that this child with the I.Q. of 112 was an exception in every classification and a puzzle in many ways We do not know what his home conditions were. The last three in this group, with high quotient scores, and good average intelligence, made reading scores at the second grade level.

The one ambidextrous child who used the left eye had a strong reversal tendency to overcome, but he was a capable little person and did it successfully.

Two children who were ambidex-

trous and used either eye exhibited no deviation from the general rule. With low quotient scores, one of them negative, and with ordinary capacity, they made reading scores that were average for some stage of 1A work.

There are 5 cases that used the right hand and left eye or the left hand and of the two ambidextrous cases using both eyes. Here we have 2 children with negative quotients, no distinct lateral dominance, one with dull normal, the other with average capacity. The dull normal makes a 1B score, the average intelligence makes a low 1A score.

TABLE 2

Combinations found clinically in the non-kindergarten group

Comparison of dominance of hand and eye with quotient score, intelligence, and reading achievement. (Cases are described by a formula giving in order the quotient score/intelligence quotient/reading level.) 23 cases.

Right dominant—2 cases
RS IQ RL
7/ 91/1A
89/ 96/Unknown

Right dominant except maze—1 case
35/ 97/Poor

Left dominant—1 case
100/128/3B (R for writing)

Left dominant except maze—1 case
13/ 96/1A (L for writing)

Right hand—Left eye—4 cases
−630/ 61/1A
63/112/2B
49/113/2A
85/ 99/2B

Left hand—Right eye—1 case
−55/ 85/1B

Ambidextrous—Right eye—7 cases
RS IQ RL
−200/ 88/1A
41/ 96/1A
75/112/1A
78/102/2B (L for writing)
87/103/2B
89/105/2A (L for writing)
95/106/2B

Ambidextrous—Left eye—1 case
−25/113/2A (L for writing)

Ambidextrous—Both eyes—2 cases
−67/ 98/1A
52/ 99/1A

Ambidextrous—no eye test—2 cases
33/ 91/1A
100/ 99/1A

the right eye. The 2 with the lowest quotients also had an I.Q. and mental age far below average, and both were doing failing work in 1A. Though one is marked with a 1A score, it was actually a score that was average for beginning 1A, and was a failure for the end of that grade. The child using the left hand and the right eye makes an interesting comparison with the first

Among the right dominant and the left dominant cases the selection is so limited as to be unsatisfactory. Here is the brightest child in the entire non-kindergarten group. She is left dominant in the tests, but writes with the right hand. Her excellent intelligence and advanced mental age (eight years) presumably enabled her to read with success despite the anomaly. Perhaps

she really belongs in the ambidextrous classification, with the high I.Q.'s of the kindergarten group, since she seems able to do whatever she likes with either hand. There is no other non-kindergarten child to compare with her.

There is a right dominant child, and a left dominant, each of whom has a low average capacity, and each of whom showed a marked tendency to reversal in the low quotient score. One made scores below average for the end of 1A in two of the three reading tests; the other was doing poor work in December, and had left the school before May. With these may be compared other children in the list who have low quotient scores and low average mental functioning. There are two right dominant, one left dominant, one ambidexter using both eyes, and one ambidexter on whom no eye test was made,—all of whom show this particular combination of low quotient score, I.Q. from 91 to 99, and reading score that was average for some stage of 1A work.

The non-kindergarten children show a greater variety in dominance than do the kindergarten group. It has been said that the untrained child is an individualist, and here we have it demonstrated. This variety among non-kindergarten children makes it difficult to make general statements based on so small a group.

We have enough cases to assert that with similar intelligence and quotient scores that are comparable, children will make similar progress in reading. Another significant relationship was found between sum scores on the reversal tests and reading progress for the non-kindergarten children. There was a correlation of .75 between sum scores in September and reading scores in May for the 83 children without kindergarten training who took both tests. For the kindergarten children, the correlation was .54. It was also found that there was a distinctly lower average of both sum scores and quotient scores for the non-kindergarten as compared with the kindergarten trained group.

CONCLUSIONS

From the results of the clinical study of children with varying degrees of reversal tendency, we may conclude:

1. The most potent factors in learning to read are intelligence and the degree of tendency to reverse and confuse symbols.

2. These 2 factors are independent variables.

3. The very bright child is capable of overcoming a strong tendency to reversal and learning to read in spite of it.

4. Other things being equal, the child with the better intelligence makes more rapid progress in reading.

5. Other things being equal, the child with less tendency to reversal makes the better progress in reading.

6. If two children vary in the same direction in both intelligence and reversal tendency, the difference in their progress is increased more than if the variation occurs in one factor only.

7. Consistent right dominance or left dominance, or ambidexterity with use of the right eye or the left eye are the conditions of lateral dominance most favorable to success in reading. This is in agreement with Dearborn.

8. Ambidexterity with use of either

eye, and use of right hand with left eye or vice versa, are less favorable to rapid progress in reading. This again confirms Dearborn.

9. The tendency to reversal is not abnormal or pathological, but occurs in every degree from total absence to severity. This confirms Orton and Illing.

10. Tendency to confuse symbols is characteristic of mental ages below six years, and is usually eliminated in mental ages above seven. This confirms Fildes.

11. Clinical identification of the prospective non-reader depends upon preliminary use of the group tests for reversal, but it is not possible to make a prognosis of reading progress from the test results alone.

12. From the results of the tests for reversal and of individual examination including a general intelligence scale and special tests of lateral dominance and reversal, it is possible to make such prognosis with a fair degree of accuracy.

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Brief Reports

The Dramatic Play of Ten Nursery School Children[1]

ALTHOUGH various investigators have observed that dramatic play makes its appearance during the pre-school years, very little experimental data has been collected. This experiment is an attempt to measure by an observational technique what four-year-old children do in a dramatic play situation.

Diary records were taken on 4 boys and 6 girls enrolled in the University of Minnesota Institute of Child Welfare. Each child was followed for three 20-minute periods on each of 2 days. His speech was recorded verbatim, and as much of the speech and activities of his playmates as could be taken down. In order to observe any continuity of play from period to period it seemed desirable to study each child during all 3 free-play periods on the day he was observed. As the maximum free-play period during the noon hour was 20 minutes, for uniformity an interval of this length was chosen in the morning, noon, and afternoon periods.

The diary records were typed in a special form to facilitate tabulation. Besides the name of the child, date and place of observation (indoors, outdoors, etc.) they contained a complete record of all speech and activity, divided into 2 columns. All sentences of the child observed were typed in the left-hand column, followed by his activities; speech of a playmate was typed in the right-hand column, with the name of the child speaking. The speech and activities were in consecutive order and gave a picture of the total period.

An original and carbon, to be used separately in scoring, were made for each record. All sentences of dramatic play were checked from these records by two observers independently. Dramatic play was defined as any verbalized activity in which the child took an imaginary rôle, played with imaginary materials, or dramatized any performance. No sentence was considered as dramatic play on which there was not agreement between the two observers. Since verbatim conversation had been recorded in preference to activity it was found that the description of unverbalized play was too inadequate to be studied.

The sentences were then listed by the two observers according to their contents. A sentence such as "My baby is going to bed now" was listed as "putting baby to bed." A separate record sheet was made for each child with separate columns for the three play periods. The number of sentences on any topic was recorded, and also the rôle taken and the name of the child making the first suggestion

[1] From the Institute of Child Welfare, The University of Minnesota.

on each topic. All sentences listed under different topics by the 2 observers were re-listed until agreement was reached.

AMOUNT OF DRAMATIC PLAY

Table 1 gives the number of dramatic sentences for each child, the number of topics he suggested, and the group average. It is apparent that there are large individual differences.

TABLE 1

Amount of dramatic play

CHILD		NUMBER OF SENTENCES	NUMBER OF TOPICS	I.Q.
Girls	1	55	11	124
	2	1	1	112
	3	11	3	106
	4	58	7	106
	5	21	5	111
	6	8	1	131
Boys	7	31	6	102
	8	47	8	96
	9	83	17	125
	10	14	6	105
Average...		32.9	6.5	

The range was from one to eighty-three sentences during the 2 hours the child was observed. Five of the children in the group are responsible for 83 per cent of the dramatic play, and at least one of them is present in each play period that lasts more than ten minutes. These totals are from direct observations on each child. Conversation of children playing with the child observed was tabulated but gave only about 1 per cent additional information and so was not used.

A rank difference correlation of .478 $\pm$.16 was obtained between the total number of dramatic sentences on the first and second days. The correlation was .928 between the total number of sentences when the child was observed directly and the total number of suggestions he made when observed directly and indirectly. The correlation between the number of sentences when directly observed and the number of suggestions when directly observed was .932 $\pm$.18. The number of minutes spent in dramatic play as estimated from records on all children, directly or indirectly observed correlated .746 with the number of dramatic sentences recorded by direct observation.

Examination of the data on the frequency of dramatic play at the various periods of the day disclosed a great difference in the value of the periods. In the morning and afternoon periods no dramatic play occurred in 60 and 65 per cent respectively of the observation periods. At noon, however, some dramatic play occurred in 80 per cent of the periods. As the records, when analyzed, showed no consistency of play from period to period, six records of each child during the noon play period would undoubtedly have given better results than the procedure used.

PATTERN OF DRAMATIC PLAY

The main problem of the experiment was to determine what the children did during the dramatic play. From the records, the two observers independently grouped the sentences according to the type of activity involved. Six major groupings were decided upon on an inspectional basis. There was almost perfect agreement between the two observers except on a number of items for which no convenient category could be found.

These were listed as miscellaneous. The number of times any topic was mentioned was obtained by counting each topic only once during any observation period.

Table 2 gives the classification of the types of activity.

Sex differences were inconsistent, although boys seemed more interested in cars, boats and trains than girls. The data on the consistency of rôles and activities of a child from period to period showed no definite trend. The average child in the group participated in 3 of the 6 types of activities listed above, during the six periods when he was observed. In 45 per cent of the dramatic play the child was taking no particular rôle. In 30 per cent of the play the rôle taken was either father, mother or baby, but there was no consistency from one period to the next. Animals, cars, boats and trains, and miscellaneous rôles followed in the order given.

TABLE 2

Types of dramatic play

TYPE OF ACTIVITY	NUMBER OF SENTENCES	PER CENT	NUMBER OF TOPICS	PER CENT
Making, using materials	37	11.21	12	11.88
Family relationships	41	11.42	13	12.87
Animals	55	16.66	12	11.88
Going places	37	11.21	6	5.94
Living conditions	64	19.39	21	20.79
Cars, boats, trains	30	9.09	15	14.85
Miscellaneous	65	19.70	23	22.77

To determine whether there was any pattern to the dramatic play, each instance of dramatic play over 1 minute long was recorded briefly giving (1) location of child and the activity just preceding dramatic play, (2) first dramatic sentence in full, (3) length of time to last dramatic sentence, and (4) activity immediately following last dramatic sentence. Two examples selected from these records are given below:

1. MJ. upstairs in gym. Crawls under bed with PQ. "Go to sleep, huh?" BAH crawls toward them. MJ says, "You can't come in, piggy." BAH: "Pretend I am outside." Play lasts five minutes. Teacher puts trapeze up near children. MJ, BAH begin to swing on it. (Those playing: MJ, PQ, BAH.) Topics of dramatizations: pig, lion.

2. BAH in dollhouse. Telling story about bear. JC says: "Play you be the bear." JS: "I'll bite your head off. I'll bite your stomach off." Play continues until time to go upstairs. (20 min.) Those playing: BAH, JC, JS, SC, PQ. Topics of dramatization: bear, playing house, doctor.

When these records were analyzed, certain definite trends appeared. About 30 per cent of the dramatic incidents began with the statement, "Let's make, I'm making, etc." One third began with the statement, "Let's play," usually followed by the assigning of rôles. The remainder began with the assumption of rôles without, definite assignments previously, as in the first record above. Termination of play also occurred in definite ways,

either through distractions, motor activity, or artificially by the end of the observation period, which generally coincided with the end of the free-play period. The distractions that ended dramatic play were such things as a child's crying or new activities being initiated by a teacher. In the rest of the cases, the incident ended when the child began to make or build something that started as dramatic play. His absorption in the actual constructive work ended his imaginative speech about it. This is an interesting illustration of the fact that speech is a substitute for action.

As some dramatic play occurred in 45 per cent of all the observations, there were enough incidents for an analysis of the records to determine whether there was any difference in dramatic play lasting less than the average number of minutes, and the longer play incidents. When dramatic play was begun, it lasted seven minutes on the average. There were 18 incidents lasting 5 minutes, and 7 incidents lasting more than 10 minutes. When these two groups were compared certain definite differences appeared. The median number of children involved in the shorter incidents was 2, and the play centered around one or two topics such as playing house. The median number of children in the longer incidents was 4, with the average 4.9. With 1 exception, all the long incidents involved at least two main topics, with three the average. All centered around playing house, with rôles assigned. Five of the 7 contained a "play within a play," such as being attacked by bears while playing house. The 2 incidents given above illustrate some of the differences.

Although these records seem to indicate a conventionalized type of dramatic play, the number of cases and observations are too small to be anything but suggestive.

REBECCA SHALLIT.

Two New Responses of Infants

IT IS surprising that two responses which are frequent occurrences in the daily life of the young infant should have escaped mention in the literature of child psychology, but I have been unable to find an account of the responses to be described below. These responses I shall call the posture of nursing and the posture of defecation. From the comparative viewpoint, the responses are an interesting parallel to the postures of feeding and defecation in the lower mammals. From the standpoint of the habit-instinct distinction, it seems that these responses must be added to our list of unlearned human responses for the burden of proof is certainly upon one who claims that they are learned prenatally.

1. POSTURE OF NURSING

If the infant is very hungry and is given a nipple, he begins nursing and at the same time the arms flex so that the fists are pulled against the body in the neighborhood of the chin while the legs and toes are extended and raised somewhat. As the infant becomes satiated this posture gradually relaxes, the legs and toes usually relaxing before the arms. If the infant is not very hungry at the beginning of nurs-

ing the leg component may be absent from the start. With still less hunger the posture may be entirely absent, although sucking will occur. (Hunger is here judged from the duration and strength of pre-nursing crying.)

2. POSTURE OF DEFECATION

With each abdominal strain of defecation there occurs a posture of the extremities which is nearly, or perhaps exactly, the same as that described above. With the abdominal contraction the legs and toes are extended and raised and the forearms are held to the upper chest. At the same time the infant may grunt and his face often reddens. In this reaction the leg component is stronger than the arm component in that the leg reaction is more certain to occur. Another difference between the two responses lies in the fact that during defecation the extremities often relax or engage in other activities when abdominal contractions are not in active progress whereas the posture of nursing is held more constantly.

These responses were first observed in a pair of twins[1] which came under my care when they were one month of age. The responses were gradually modified in later months, but these changes cannot be discussed here. Since the initial observations I have observed fifteen newborn infants during one or more periods of feeding and temperature charting. In addition, five prematures, born at seven months' pregnancy, were also observed about one hour per day (at times of bathing, feeding, and temperature charting) for six weeks. In the case of the prematures the responses could not be studied easily during the first four weeks because the babies were almost constantly enclosed in premature jackets, but during some brief opportunities one of the infants was observed in a posture of nursing and four of them in a posture of defecation. When the jackets were removed in the fourth week, the responses were present in all infants and were observed many times during the remaining two weeks of the hospital period. It should be mentioned, however, that the prematures were often completely relaxed and even asleep while they were nursing.

All of the above observations of nursing refer to bottle nursing. No observations of breast nursing have been made, but it seems altogether likely that the same response is given at the breast.

The posture of defecation was often elicited during the taking of rectal temperatures. The thermometer frequently, but not always, caused defecation and the accompanying posture.

The responses are apparently not invariable. One of the prematures at one time flexed his legs during part of an act of defecation and during one nursing period. The same subject held his fists against the sides of his head during another nursing period, although at other times his behavior conformed to the descriptions given above. No other exceptions were observed.

WAYNE DENNIS.

[1] The study of the twins was made possible by the Institute for Research in the Social Sciences at the University of Virginia. For the opportunity to observe the newborn I am indebted to Dr. D. L. Royster, Professor of Pediatrics at the University of Virginia, and to Miss Broyles and Miss Phillips, nurses in charge of the University Nursery.

CORRECTION

May I call attention to an error in the article, *Language Development in Twins*, by Ella J. Day which appeared in the September 1932 issue of CHILD DEVELOPMENT. On page 182 the first of McCarthy's rules for scoring length of responses is quoted as:

> "Contractions of subject and predicate like *it's* were scored as *one* word."

But McCarthy, in *Language Development of the Preschool Child* (University of Minnesota Press, Institute of Child Welfare, Monograph Series No. IV) p. 36, gives the rule as:

> "Contractions of the subject and predicate like *it's, we're, you're,* etc., were scored as *two* words."

The latter was also the procedure followed by Day. Since the McCarthy rules have been adopted by other students of language development, it seems advisable to correct the error which inadvertently crept into the article during the process of publication.

JOHN E. ANDERSON.

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